UNIVAC **DATA FOR COPYRIGHT REGISTRATION**

TITLE

UNIVAC 9200 II/9300/9300 II Systems Magnetic Tape Sort Programmer Reference, UP-4142 Rev.2

NAME AND HOME ADDRESS OF AUTHOR

Edward F. Szpindor 19 Marcel Ave. Spring City, Pa. 19475

CITIZENSHIP OF AUTHOR

USA

DATE OF PUBLICATION (RELEASE)

January, 1973

NEW WORK

No

REVISION

Yes

TITLE, AUTHOR AND DATE OF ORIGINAL WORK AND/OR PRIOR REVISIONS

UNIVAC 9300 System Tape Sort Programmers Reference, UP-4142 Rev. 1
T. F. Lyszkowski May 13, 1969

CHANGES FROM ORIGINAL AND/OR PRIOR REVISIONS

This document now provides the programmer with information concerning run time for the sort in Section 2 and an Appendix containing sort timing. Corrections have been made to the descriptions of sort control parameters and own code, and also to the sort parameters in Section 5.

NAME AND ADDRESS OF PHOTOENGRAVER

N/A

NAME AND ADDRESS OF TYPESETTER

UNIVAC P. O. Box 500 Blue Bell, Pa. 19422

NAME AND ADDRESS OF PRINTER

Same as above.

NAME AND ADDRESS OF BINDER

N/A

UNIVAC
SYSTEMS
PUBLICATIONS

UNIVAC 9200 II/9300/9300 II

REVISION

Magnetic Tape Sort
Programmer Reference
UP-4142 Rev. 2

This UNIVAC 9200 II/9300/9300 II Systems Library Memo announces the release and availability of "UNIVAC 9200 II/9300/9300 II Systems Magnetic Tape Sort Programmer Reference," UP-4142 Rev. 2. This is a Standard Library Item (SLI).

This revision contains additions and corrections to the "UNIVAC 9300 System Tape Sort Programmers Reference," UP-4142 Rev. 1. This document now provides the programmer with information concerning run time for the sort in Section 2 and an Appendix containing sort timing. Corrections have been made to the descriptions of sort control parameters and own code, and also to the sort procedures in Section 5.

Destruction Notice: This revision supersedes and replaces "UNIVAC 9300 System Tape Sort Programmers Reference," UP-4142 Rev. 1 released on Library Memo 20 dated May 13, 1969. Please destroy all copies of UP-4142 Rev. 1 and/or Library Memo 20.

Request additional copies through your local Univac Manager via a Sales Help Requisition Form. These forms are submitted to:

Customer Information Distribution Center (CIDC)
Univac Division Sperry Rand Corporation
P.O. Box 448
King of Prussia, Pa. 19406

H. MASTERS
Group Manager
Systems Publications

LISTS	ATTACHMENTS	THIS SHEET IS:
217, 630 and 692 Library Memo only	UP-4142 Rev. 2 (covers and 115 pages) plus Library Memo to Univac Library Mailing Lists 54, 54D, 55, 55D and 56	Library Memo for UP-4142 Rev. 2
		DATE: January 1973

SPERRY RAND

SPERRY RAND

UNIVAC

9200 II/9300
9300 II SYSTEMS

MAGNETIC TAPE SORT

PROGRAMMER
REFERENCE

UP-4142
Rev. 2

This document contains the latest information available at the time of publication. However, the Univac Division reserves the right to modify or revise its contents. To ensure that you have the most recent information, contact your local Univac Representative.

UNIVAC is a registered trademark of the Sperry Rand Corporation.

Other trademarks of the Sperry Rand Corporation in this publication are:

UNISERVO

PRINTED IN U.S.A.

PAGE STATUS SUMMARY

ISSUE: UP-4142 Rev. 2

Section	Page Number	Update Level
Cover/Disclaimer		Orig.
PSS	1	Orig.
Contents	1 thru 4	Orig.
1	1 thru 6	Orig.
2	1 thru 6	Orig.
3	1 thru 10	Orig.
4	1 thru 6	Orig.
5	1 thru 14	Orig.
Appendix A	1 thru 7	Orig.
Appendix B	1 thru 5	Orig.
Appendix C	1 thru 4	Orig.
Appendix D	1 thru 4	Orig.
Appendix E	1 thru 7	Orig.
Appendix F	1 thru 32	Orig.
Index	1 thru 7	Orig.

Section	Page Number	Update Level

Section	Page Number	Update Level

CONTENTS

INDEX

FIGURES

TABLES

1. INTRODUCTION

1.1. GENERAL

This manual describes the tape sort program provided for use with UNIVAC 9200 II/9300/9300 II Systems Magnetic Tape Sort (sort program) and, in detail, the capabilities of the program.

For the most effective use of this manual, the reader should be familiar with the instruction repertoires of the UNIVAC 9200 II/9300/9300 II Systems. Review of the following UNIVAC 9200/9300 Systems manuals is recommended:

- UNIVAC 9200/9300 Systems Central Processor and Peripherals Programmer Reference, UP-7546 (current version)
- UNIVAC 9200/9200 II/9300/9300 II Systems Descriptions, UP-7806 (current version)
- UNIVAC 9200/9200 II/9300/9300 II Systems Card Assembler Programmer Reference, UP-4092 (current version)
- UNIVAC Systems Card Utility Programs Programmer Reference, UP-4120 (current version)
- UNIVAC 9200/9200 II/9300/9300 II Systems Card Utility Programs Programmer Reference, UP-4120 (current version)
- UNIVAC 9200 II/9300/9300 II Systems Magnetic Tape Input/Output Control System Programmer Reference, UP-4135 (current version)

Section 1 of this manual contains a summary of the structure and features of the sort program; Section 2 covers the general programming and hardware requirements; Section 3, the input stage; Section 4, the output stage;and Section 5, the procedures for using the sort program. Appendix A contains a summary of the operating procedures; Appendix B, a summary of statements and operands; Appendix C, examples of own code and cross referencing; Appendix D, programming examples; Appendix E, sort error displays; Appendix F, timing information.

1.2. SORT PROGRAM FEATURES

The UNIVAC 9200 II/9300/9300 II Systems sort program is designed to:

- provide a highly efficient and comprehensive sorting capability that can be applied to a wide range of data processing requirements; and to
- produce a sort program for which operating procedures are simple, straightforward, and not subject to exception.

1.2.1. Sort Program Structure

The sort program is in absolute loadable format. Parameters for the program are established by statement cards and own-code modules. Own-code modules are in relocatable format produced by the assembler. The card system sort program operates in conjunction with the the minimum operating system (MOS). It consists of three decks between which statement cards and own-code modules are inserted. If the input file is a deck of cards, it can be placed in the hopper of the card read unit immediately after the last sort deck.

The sort program is included in the systems tape of the nonconcurrent operating system (NCOS) or concurrent operating system (COS).

In the sort program, statement cards enter the program sort from the control stream, and own-code modules enter from the control stream or a library tape. The input data file may follow the sort parameters and own code in the control stream.

A sorting operation takes place in three stages — setup, input, and output.

During the setup stage the sort program performs the following functions:

- It reads and processes all statement cards and own-code modules. Blank cards in the statement deck are ignored.
- It adjusts itself according to the specifications on the statement cards.
- It relocates and incorporates own-code modules for later use during the input and output stages.
- It does the label checking and creation specified for the first and last work tapes.

During the input stage, the program sort performs all operations required to reach the end of the input file. Specified label checking is included. In a multicycle sort, all required ordered subfiles are produced.

During the output stage, the sort program performs all operations required to complete production of a sorted output file. This includes:

- specified label operations;
- final collation pass of the sort process in a single-cycle sort; and
- merges required to reduce the ordered subfiles produced in the input stage of a multicycle sort to one ordered output file.

1.2.2. Hardware Requirements

The user specifies, on a statement card, the number of magnetic tapes to be used. The user also may specify the amount of main storage to be used or may allow the sort program to allocate the amount of memory available at the time the sort is loaded.

Sorting is possible in a UNIVAC 9200 II/ 9300/9300 II Systems with a 12,288-byte memory and a minimum of three magnetic tape units, but if more memory and tape units are available, the sort program adjusts automatically to the expanded equipment configuration.

1.2.3. Work Tape Labels

The work tape for the program sort is not designed to be used as input to another program; however, the user may require that:

- certain security measures, such as checking the expiration date in the first file header label of a tape designated to become a work tape, must be performed;
- because the data currently recorded on a tape designated as a work tape is to be overwritten, the file header label indicating the presence of that data also must be overwritten;
- the file header label on a work tape, after its use, must be intelligible to subsequent label checking routines and must indicate the presence of sort work tape data.

  Consequently, the sort program provides for execution of an output tape label check and a label creation routine for each work tape.

1.2.4. Input

The sort program enables the user to:

- provide own code to completely control delivery of input to the program;
- describe an input file in terms of statement cards similar to file description cards used in describing a tape input file to the magnetic tape input/output control system (IOCS); the sort completely controls the input from this file.

The sort program does the housekeeping involved in handling the file and delivers each input record, in turn, to own code for processing. In this case, the own code determines whether the record is to be delivered to the program and triggers the delivery of records from the input file by executing GET macro instructions and causes records to be written on the output file by executing PUT macro instructions.

1.2.5. Output

The sort program enables the user to:

- provide own code to completely control the disposition of records produced by the sort.
- describe an output file in terms of statement cards similar to the file description cards used in describing a tape output file to the IOCS. The sort program completely controls the output to this file.

The sort program performs the housekeeping involved in handling the file and delivers each sorted record, in turn, to own code for processing. In this case, the own code determines whether the record is to be written on the output file. Own code triggers the delivery of records from the program by executing GET macro instructions and causes records to be written on the output file by executing PUT macro instructions.

1.3. RECORDS

Records to be sorted may be any fixed number of bytes in length or they may be the standard variable-length record format.

1.3.1. Sequence

Key fields for sequencing records may be described to the program sort by the user. Alternatively, own code designed to do the comparisons necessary to determine record sequence may be supplied.

When key field description is chosen:

- As many key fields as desired may be described.
- Each key field may appear anywhere in the record.
- Each key field may contain alphanumeric, unpacked decimal, packed decimal, or signed binary data.
- Each key field may be tested for ascending or descending sequence.

1.3.2. Data Reduction

In some applications, records are sorted for tabulation. If the tabulation requires only subtotals and totals, the lowest level of subtotaling can take place while records are being sorted. Subtotaling occurs when the sort finds two records in sequence with identical values for all key fields. The appropriate fields of one of the records are combined with the corresponding fields of the other, and the former record is eliminated from further processing. Data volume is reduced, thereby reducing sorting time.

Data reduction is especially advantageous when it occurs early in the sort process. Early data reduction occurs when records with identical key field values tend to appear close together in the input data stream. Such batching occurs frequently.

For example:

- Source documents are batched for delivery to the data processing system.
- The input file is already sorted on a set of key fields. The more significant set of these key fields is also the more significant set of key fields for the current tape sort.
- The input file is sorted on a set of key fields the same as the set for the current tape sort; however, key fields are in a different order of significance in the two sets.

Because of the influence of input sequence on savings, it is difficult to estimate what gain can be realized by data reduction of a given input file but experience shows these savings are large in some cases.

If the user wishes to eliminate records with duplicate key field values, he specifies elimination on a statement card. The user supplies own code if he wants to process records with duplicate key field values.

1.3.3. Data Volume

The sort program functions properly with any volume of data including no data at all. The case of sorting no records may occur unexpectedly when user own code selectively deletes records from the input file.

Records are ordered by moving them from one work tape to another. If the quantity of data to be sorted exceeds the capacity of the work tapes currently mounted and available, a set of ordered subfiles is produced. Ordered subfiles are later merged to produce the sorted output file. The merging operation is an automatic feature of the sort program after all input data has been sorted down to the subfiles. To produce the subfiles, the tape program sort must enlist the operator's aid to:

- demount each intermediate output tape as soon as an ordered subfile is produced;
- mount a blank tape for the next ordered subfile; and
- remount ordered subfiles for merging at the end of the input stage.

By these means, the work tape storage accessible to the program sort is extended far beyond the number of tapes that can be mounted at one time.

Demounting and remounting of ordered subfiles is simple and systematic. Because the subfiles are written and read by the sort program, a thoroughly reliable checking procedure is incorporated to guarantee that subfiles are remounted in the correct sequence for merging.

The sort operation in which ordered subfiles are produced is known as the multicycle sort. The sort operation in which no ordered subfiles are produced is known as the single-cycle sort.

1.4. RESTART

Unpredictable interruptions in the sorting process, such as hardware failure or operator error, could make restarting the sort process necessary at the beginning. The time lost in restarting is undesirable when the quantity of data to be sorted is large.

For this reason, the sort program gives the operator the ability to restart the sort process at a recently completed point rather than at the beginning. Checkpoints are set up at the beginning of the production of each tape in an ordered subfile. The amount of data the program records on each tape in an ordered subfile may be specified by the user in a statement card; therefore, the user may determine the frequency of checkpoints.

Checkpoints at the beginning of production of each tape in an ordered subfile have another advantage. Assume that the unrecoverable error necessitating restart is the inability to read a tape in an ordered subfile during the merging operation. The restart provisions of the sort program enable the operator to restart the sort process at the point where the unreadable tape is to be produced, reproduce the tape, then restart the merging operation at the last checkpoint passed before the unreadable tape was detected.

Restart also may be necessary because a program of higher priority must be put on the processor before a sort process is completed. The operator can interrupt the sort process by making an unsolicited keyin, which causes the sort to rewind, with interlock, all tapes allocated to it. If these tapes are remounted after the emergency is over, the sort program can position the tapes at the point of interruption and resume the sort process as if the interruption had not occurred.

1.5. SEGMENTED SORTING

When large amounts of data are involved in a sort process, sorting can be scheduled in several disconnected segments of real time. For example, portions of a large volume of data to be sorted might become available at weekly intervals over a period of a month. Each of these portions can be sorted into an ordered subfile when the information is available. The ordered subfiles can then be merged at the end of the month. Segmented sorting enables the programmer to load and execute only the stage of the sort program that is desired.

1.6., STATEMENT CONVENTIONS

The conventions used to illustrate statements in the manual are as follows:

- Capital letters and punctuation marks (except braces, brackets, and ellipses) are information that must be coded exactly as shown.
- Lower case letters and terms represent information that must be supplied by the programmer.
- Information contained within braces represents necessary entries, one of which must be chosen.
- Information contained within brackets represents optional entries that (depending on program requirements) are included or omitted. Braces within brackets signify that one of the entries must be chosen if that operand is included.
- An ellipsis indicates the presence of a variable number of entries.
- In the coding of macros, commas are required after each parameter except after the last parameter specified. When a positional parameter is omitted from within a series of parameters, the comma must be retained to indicate the omission.

2. GENERAL PROGRAMMING AND HARDWARE REQUIREMENTS

2.1. PROGRAMMING REQUIREMENTS

Input to the UNIVAC 9200 II/9300/9300 II Magnetic Tape Sort (sort program) may be in the form of statement cards or own code. The majority of the statement cards and all of the own code are optional. A functional sort program can be implemented with as few as five statement cards and no own code.

2.1.1. Statement Cards

A statement card is formatted the same as a macro instruction except that a statement card never carries a label. Rules for entries in the operation field, the operand field (including positional and keyword parameters), the comments field, and continuation to the next card are identical to the entries for a macro instruction. Possible statement operation field entries are:

- TAPES

  Specifies work tapes.

- IN

  Describes the input file.

- ILB

  Specifies the input file label.

- WLB

  Specifies the work tape label.

- FIELD

  Describes key fields.

- OUT

  Describes the output file.

- OLB

  Specifies the output file label.

- RSTRT

  Specifies that restart of a sort process, rather than a start from beginning, is to be initiated.

- PART

  Specifies that only a portion of the sort process is to be performed.

- SORT

  A general statement describing various aspects of the sort program.

- END

  Marks the end of the statement cards in the statement card deck. Unlike the other statement cards, an END statement card has no parameters.

Except for the TAPES, IN, FIELD, OUT, and END statements, all of the preceding statements are optional and are used only when the functions they perform is desired. In addition, the sort program setup stage enables submission of more than one SORT statement; thus, all of the SORT statement parameters do not need to be strung out in the operand field of a single SORT statement. They can be grouped in several SORT statements. One functional grouping would be to put all the SORT parameters not expected to change in one statement. The parameters expected to change would be grouped in as many SORT statements as required to elect the various options with a minimum of SORT statement substitution. For example, one SORT statement parameter specifies the amount of memory to be used by the sort program. The specification should be placed by itself in a SORT statement if the parameter is expected to vary.

2.1.2. Own Code

In many cases, a statement parameter is specified in terms of a label. The label specified can be externally defined in own code. Sometimes the specification of a parameter indicates that the sort program is to transfer control to the specified label to allow own code to perform a characteristic function. Such parameters occur in the IN, FIELD, SORT, and OUT statements. The names of these parameters and the own-code function associated with each follows:

- IN statement

LBAD	Specifies input file label check own code.
LBRC	Specifies special entrance to input label check own code to be used during multicycle sorting.
IPRO	Specifies input procedure own code to process input records.
ERRO	Input read error own code.
EOFA	Specifies end of input file own code.

- FIELD statement

RSOC	Specifies record sequence own code.

- SORT statement

  LBAD — Specifies work tape label handling own code.

  DROC — Specifies data reduction own code.

- OUT statement

  LBAD — Specifies output file label handling own code.

  OPRO — Specifies output procedure own code to process output records.

  EOFA — Specifies end of sorted data own code entered by the sort program when no more sorted records are to be delivered to the output procedure.

The sort program always transfers control to own code by way of a BAL (branch and link) specifying register 14 as the return register. The program does not preserve the own-code registers.

The sort program requires unique 4-character labels in any user own code.

Own code may consist of one or more independently assembled modules. These modules must be assembled, assigning 0 value to the operand of the START directive. Header cards must be supplied surrounding the modules to indicate to the sort program the phase during which the module is to be loaded into main storage. A module externally defining labels specified in the IN statement may be included only during the input phase. Similarly, own code pertaining to the OUT file may be included only during the output phase. All other own-code modules are common to the program and occupy main storage during the complete sort process.

Minimization of main storage space required by own code is conducive to tape sorting efficiency. This is particularly true of own code that occupies storage during the complete tape sort process; however, the user may include all own code in one module if he wishes to assemble all the own code at one time.

Own code may make external references to labels externally defined in the sort program. These labels are:

- ILBF

  Specifies input file ID location.

- ILBC

  Specifies input file creation date location.

- ILBG

  Specifies file generation number location.

- ILBV

  Specifies input file volume number location.

- IN

  Specifies input filename.

- WLBF

  Specifies work tape file ID location.

- WLBC

  Specifies work tape creation date location.

- WLBG

  Specifies work tape generation number location.

- WLBV

  Specifies work tape volume number location.

- WLBX

  Specifies work tape expiration date location.

- SORT

  Specifies sort filename.

- DELE

  Specifies record deletion routine for data reduction.

- OLBF

  Specifies output file ID location.

- OLBC

  Specifies output file creation date location.

- OLBG

  Specifies output file generation number location.

- OLBV

  Specifies output file volume number location.

- OLBX

  Specifies output file expiration date location.

- OUT

  Specifies output filename.

- RES

  Specifies base location of a communication area common to the input and output procedures.

The input filename can be referenced only during the input stage, and the output filename can be referenced only during the output stage. All other externally defined labels are available for reference during the complete tape sort process.

An own-code module can be used to reference entries externally in another module only if:

- the reference is one requiring a 2-byte address substitution without an addend; and
- the reference is a 2-byte address plus an addend and the defining ENTRY is in a module preceding the EXTRN; that is, the element containing the ENTRY must be loaded prior to the element containing the EXTRN.

Examples are given in Appendix B.

Own code may use either indexed or direct addressing.

2.2. HARDWARE REQUIREMENTS

The hardware requirements for a tape sort operation are described in the following paragraphs. Specifications of work tapes, storage, and tape length requirements also are included.

2.2.1. Work Tapes

Sort work tapes are specified in a TAPES statement operand consisting of a number of positional parameters. Each positional parameter specifies the logical unit number of a work tape. At least three magnetic tape units must be so specified.

The sort program determines the physical characteristics of the work tape units by inspecting the appropriate physical unit table entries. If 7-track magnetic tape units are used as work tape units, the data conversion option must be incorporated in the tape control unit; however, if the input file is recorded in 7-track mode with no data conversion, the speed of the sort program is increased if the work tape units are described in the physical unit table of the supervisor program as not using the data conversion feature.

Combinations of 9- and 7-track tapes may be used in the input stage (or PART INPUT), but not in the merge (or PART OUTPUT). For variable records, 7-track tapes without the conversion option cannot be used. For fixed records, the record length given in the SORT statement must be a multiple of six if 7-track tapes are used.

The running time for a tape sort can be reduced by using the systems tape drive (logical unit 0) as a work tape drive by:

1. Entering the systems tape address (00, for example) in the TAPES statement card but not as the first or last of the parameters; that is, TAPES 01, 00, 02, 03.

   NOTE:

   Do not use CLRW=RWD as a keyword parameter. By not specifying this parameter, the output tape is rewound with interlock automatically at the end of the sort program.

2. Ensuring that the write enable ring is removed from the systems tape reel; if not removed, no distinct halt occurs to indicate this condition.

3. Replacing the systems tape with a work tape when the sort program stops with either a 60U2 or 60U1 halt display (Appendix E).

4. Pressing START switch on operator control panel.

Upon completing the run, the sort program attempts to read tape unit 0 in search of job control. Because the systems tape has been removed, the operator will not experience the normal termination of the sort; i.e., a job control loop (refer to UNIVAC 9200/9200 II/9300/9300 II Systems Operating System Programmer Reference, UP-7531 (current version) for possible stop conditions).

Rewinding of the output tape with interlock (LOCAL indicator lit) may be considered an indication that the tape sort is completed. When this indication appears, the process can be stopped and the systems tape can be remounted.

2.2.2. Main Storage Space

Main storage space available for running a main program is indicated in the boundary table at the time the sort program is loaded. The sort program uses this amount of memory unless instructed otherwise. If the user wishes to restrict the amount of storage to be used by the sort, he can do so by including, in a SORT statement, the keyword parameter:

STOR=n

where:

the highest numbered byte the sort program is to use is indicated in n. The amount of storage allocated in this fashion must be equal to or less than the amount listed in the boundary table of the supervisor program as available for main program use.

2.2.3. Tape Length

The sort program assumes that all tapes have a usable length of 2400 feet. Any other length can be specified to the sort by including in a SORT statement the keyword parameter:

TAPE=n

where:

n is the specified length of tape in feet.

3. SORT PROGRAM INPUT

3.1. LABEL INFORMATION

At execution time of a UNIVAC 9200 II/9300/9300 II Magnetic Tape Sort (sort program), the user may specify the values to be used to check the header label of the input file with an ILB statement. The ILB statement format is:

LABEL	b OPERATION b	OPERAND
	ILB	f,c,g,v

where:

f Specifies the file identification.

c Specifies the creation date.

g Specifies the generation number.

v Specifies the volume number.

The values specified are sorted in fields labeled ILBF, ILBC, ILBG, and ILBV, respectively. Field ILBF is eight bytes in length; field ILBC, five bytes; field ILBG, four bytes, and field ILBV, two bytes. The fields are found in main storage in the order listed, the dating constant ILBC preceded by a space. If an ILB statement is not presented to the sort program, ILBF will contain the value:

SORTFILE

and fields ILBC, ILBG, and ILBV will contain unsigned decimal 0's in unpacked format.

3.2. SORT CONTROL

When the sort program controls input, the input file is described in the operand field of the IN statement in the form of keyword parameters similar to those used in a DTFMT (define the file for magnetic tape) macro instruction to describe an input file to the magnetic tape IOCS. The keyword parameters are reviewed here, and the difference between the use of the parameter in the IN statement and the DTFMT macro instruction is noted.

BKSZ=n

Whether the record format of the input file is fixed, variable, or undefined, a maximum block size must be specified for the file.

CKPT=YES

The sort routine automatically bypasses the checkpoint dumps recorded on the input file.

CLRW=NORWD

The tape is not to be rewound after the input file is closed.

CLRW=RWD

This macro instruction is used for a rewind operation if additional tape drives are specified beyond the minimum three work tapes. The sort routine assumes that the tape on which the input file is recorded is to be rewound with interlock after the file is closed. If the tape is to be rewound without interlock after the file is closed, the keyword parameter, CLRW=RWD, must be included; however, if the logical tape unit number specified for the input file is the same as a logical tape unit number specified for a work tape or an output file, the keyword parameter, CLRW=RWD, cannot be used.

CRDT=symbol

If the user does not specify the creation date, the sort routine operates as if the specification were CRDT=ILBC.

DEVA=nn

The logical tape unit number specified for the input file may be the same as a logical tape unit number specified for a work tape or for the output file; however, the same logical tape unit number may not be specified for all three. If the logical tape unit number specified for the input file is the same as that specified for a work tape, it must be the logical unit number specified last in the TAPES statement.

ERRO=IGNORE

The sort routine processes the block containing the error as though no error has occurred.

ERRO=SKIP

The sort routine skips the block containing an error.

FLBL=NO

The input file is unlabeled.

FLBL=NSTD

The input file contains nonstandard labels.

FLID=label

If the user does not specify the location of the input file identification, the sort program operates as though the specification were FLID=ILBF.

GENO=label

If the user does not specify the location of the generation number, the sort program operates as though the specification were GENO=ILBG.

LBAD=label

This keyword parameter is used when nonstandard labels are to be checked on the input file. The user must define his own input area, and symbol is the symbolic label of the first byte of a user label routine to process nonstandard labels.

LBRC=label

The LBRC parameter is unique to the IN statement. The symbol specifies the symbolic label of a special entrance to the user routine for checking input labels used during multicycle sorting (5.3).

OPRW=NORWD

The tape is not to be rewound before the input file is opened. Normally, the tape on which the input file is recorded is rewound without interlock before the file is opened.

RCFM=VARBLK

The record format for the input file is variable in length and blocked.

RCFM=VARUNB

The record format for the input file is variable in length and unblocked.

RCFM=UNDEF

The record format for the input file is undefined.

RCSZ=n

If the record format for the input file is of fixed length and blocked, n is the number of bytes in the record. For an input file with an undefined record format, n is the number (8–13) of a general register containing the record size.

When 7-track tape units with data conversion are used, the RCSZ must be a multiple of six. File integrity can be maintained by adding a sort RCSZ=48 plus an OPRO to handle the larger RCSZ during output.

READ=BACK

The input file is to be read backward. A file written on a 7-track tape with data conversion can be read backward only if the size of each block written is a multiple of three bytes.

VOL=n

The VOL parameter is unique to the IN statement. If specified, the sort program reads n volumes of the input file, then takes end-of-file action on the n^{th} volume; the trailer labels at the end of preceding volumes are ignored.

A VOL parameter must be specified if a multicycle tape sort operation is desired.

VOLN=symbol

If the user does not specify the location of the volume number, the sort program operates as though the specification were VOLN=ILBV.

3.3. OWN-CODE CONTROL

Parameters described in 3.2 do not appear in the IN statement if own code controls input. Instead, the single keyword parameter IPRO appears in the IN statement, and the specification of the parameter is the entry point to the input procedure.

The sort program transfers control to the input procedure entry point when it is ready to accept input data. The input procedure then assumes complete initiative in delivering records to the program.

Each record to be sorted is delivered by executing the imperative macro instruction:

```
LABEL    ↹ OPERATION ↹    OPERAND                    ↹
1            10           16
         PUT              SORT,workarea
```

The symbol SORT must be defined as an external reference in the input procedure. If the record to be delivered to the sort program is not in a fixed work area but is pointed to by register n, the record can be delivered with the sequence of instructions:

```
         STH              n,*+8
         PUT              SORT
```

The STH instruction stores the record address in the calling sequence generated by the PUT macro instruction.

After the last record to be sorted is delivered, the input procedure is terminated by the imperative macro instruction:

```
         CLOSE            SORT
```

NOTE:

Do not use OPEN SORT for controlling IPRO because SORT has already been opened.

3.4. COMBINED CONTROL

If own code controls input to the sort program but delegates the task of input file control to the sort program, the IPRO parameter and the parameters described in 3.2 appear in the IN statement. In addition, the following requirements must be met:

- Either the keyword parameter

  WORK=YES

  or the keyword parameter

IORG=n

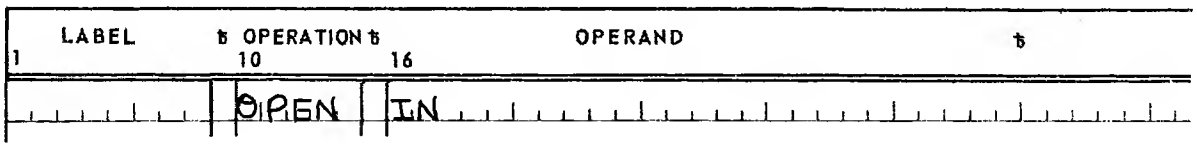
must appear in the IN statement. These parameters are used in the same way as in the DTFMT macro instruction.

- The keyword parameter

  EOFA=label

  must appear in the IN statement, where label is the label of the entry point in the input procedure to which the sort program is to transfer control when the end of the input file is reached.

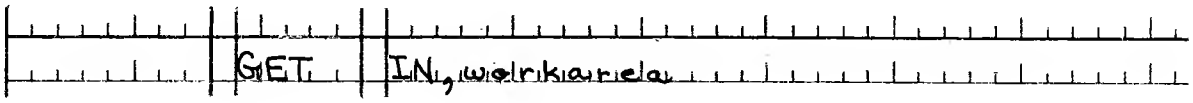
The imperative macro instruction is:



This instruction is used in the input procedure to open the input file.

The symbol IN must be defined as an external reference in the input procedure.

The input procedure receives the next record from the input file by executing the imperative macro instruction:

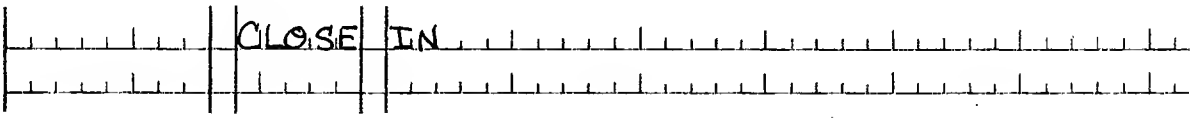


The parameter workarea is optional.

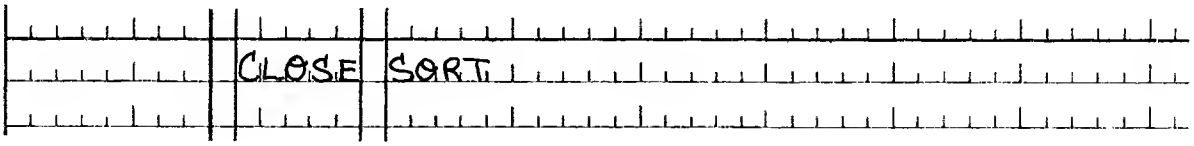
Own code delivers records to the sort program as described in 3.3.

At the end of the input file, control is transferred to the label specified in the EOFA keyword parameter.

After an end-of-file return, the input file is closed by executing the macro instruction:

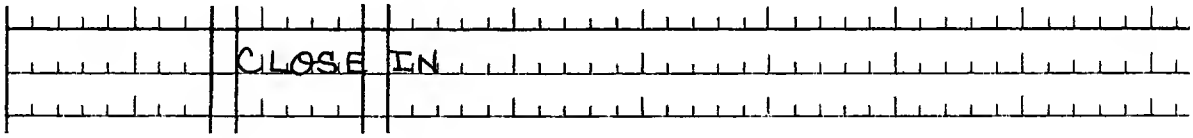


The input procedure directs the sort program to perform the next step in the sort process by executing the macro instruction:

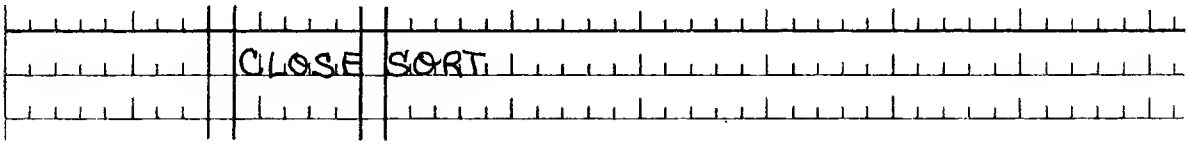


After this macro instruction is executed, control does not return to the input procedure for the remainder of the sort process.

The input procedure does not need to wait for an end-of-file return to perform the next step in the sort process. It can close the input file at any time by executing the macro instruction:



After closing, the input file the input procedure can, at any time, direct the sort program to perform the next step in the sort process by executing the macro instruction:



3.5. SORT RECORD SIZE

If input record size is specified in the IN statement and record size for the tape sort is the same as input record size, no further specification of sort record size is necessary. Otherwise, the SORT statement must include the keyword parameter:

RCSZ=n

where:

n is the number of bytes in the record if record format is of fixed length. If record format is of variable length, n is the number of bytes in the maximum record size.

In the case of variable-length records, maximum record size should include the 4-byte record length field. If the sort record size is variable and the keyword parameter RCSZ appears in a SORT statement, the statement also must include the keyword parameter:

RCFM=VAR

3.6. WORK TAPE LABELS

For each work tape specified in the TAPES statement, the tape sort program performs a standard output header label check and creation procedure. This procedure is automatic unless the tape sort is instructed by a keyword parameter to do otherwise.

The WLB statement is used if the user wishes to specify the values to be used in checking and creating the work tape header label. The WLB statement has the format:

LABEL	OPERATION	OPERAND
	WLB	f,c,g,v,x

where:

f Specifies the file identification.

c Specifies the creation date.

g Specifies the generation number.

v Specifies the volume number.

x Specifies the expiration date.

The specified values are stored in fields labeled WLBF, WLBC, WLBG, WLGV, and WLBX, respectively. Field WLBF is eight bytes in length; field WLBC, five bytes; field WLBG, four bytes; field WLBV, two bytes; and WLBX, five bytes. The fields are found in main storage in the order listed; each of the dating constants WLBC and WLBX is preceded by a space. If a WLB statement is not presented to the sort program, field WLBF will contain the value:

SORTTAPE

and fields WLBC, WLBG, WLBV, and WLBX will contain unsigned decimal 0's in unpacked format.

If work tapes are to be subjected to a standard output header label check and creation procedure, the user may instruct the sort program where to locate the file ID, creation date, generation number, volume number, and expiration date for the procedure by including in a SORT statement the keyword parameters:

FLID=label

where:

label is the label of the first byte of the file identification. If the user does not specify FLID, the tape sort operates as if the specification were FLID=WLBF.

CRDT=label

where:

label is the label of the creation date. If CRDT is not specified, the sort program operates as if the specification were CRDT=WLBC.

GENO=label

where:

label is the label of the generation number. If GENO is not specified, the tape sort operates as if the specification were GENO=WLBG.

VOLN=label

where:

label is the label of the volume number. If VOLN is not specified, the tape sort operates as if the specification were VOLN=WLBV.

XPDT=label

where:

label — is the label of the expiration date. If XPDT is not specified, the tape sort operates as if the specification were XPDT=WLBX.

The following keyword parameter should be included in a SORT statement if no label procedure is desired for work tapes:

FLBL=NO

If a nonstandard label procedure is desired for work tapes, the following keyword parameter should be included in a SORT statement:

LBAD=label

where:

label — is the entry point to an own-code label procedure. The sort program enters the label procedure before writing on each work tape. Upon entry, register 8 contains the character 0 in the least significant byte; byte 29 under register 9 contains the logical tape unit number of the work tape for which the label procedure is entered. On exit from the label procedure, the program writes on the work tapes as it is left positioned by the label procedure. Note that an own-code label procedure can address the areas labeled WLBF, WLBC, WLBG, WLBV, and WLBX, and that a WLB statement can be used to place values in these locations for use by the own-code label procedure.

3.7. RECORD SEQUENCE

The sort program sequences records in a file based on one or more key fields in a record. A key field is described in a FIELD statement. Optionally, the programmer may supply own code to perform the sequencing operation.

3.7.1. FIELD Statements

The key fields are described in a series of FIELD statements. Each FIELD statement describes one key field and must appear in a statement deck in order of significance, major to minor. Each key field described by a FIELD statement must lie completely within the first 4096 bytes of the record.

The format of a FIELD statement is:

LABEL	␣ OPERATION ␣	OPERAND
	FIELD	p,n,f,s

where:

p — Specifies the number of the position in the record of the most significant byte of the key field. Bytes of the record are numbered, starting with 1, from low-order to high-order main storage. When numbering the bytes of variable-length records, the 4-byte record length field is considered to be part of the record.

n — Specifies the number of bytes in the key field.

f — Specifies the format code of the key field.

Field formats, codes, and associated maximum lengths in bytes are listed in Table 3–1.

Format	Code	Maximum Length
Character	CH	256
Binary	BI	256
Packed decimal	PD	16
Zoned decimal	ZD	16
Fixed-point integer	FI	256

Table 3–1. Field Statement, F Parameter Characteristics

If f is not specified, the sort program operates as if the specification were CH.

Where s is a code for the sequence in which a series of records (all of which contain the same values in all the more significant key fields) are to appear in the sorted output file. The code for an ascending sequence is an A; the code for a descending sequence is a D. If s is not specified, the tape sort program operates as though the specification were an A.

3.7.2. Own Code

The following keyword parameter must appear in a FIELD statement when the user is supplying own code to determine record sequence:

RSOC=label

where:

label is the entry point to this record sequence own code.

The sort program enters record sequence own code each time the program wishes to know which of two records is to appear first in the sorted output file. At the time of entry, register 11 points to one record, and register 12 to the other record. The records may not be stored on half-word boundaries; therefore, they may not be addressed by RX format instructions. In the case of variable-length records, the 4-byte record length field is considered a part of the record. When exiting from record sequence own code, the condition code must be set to low if the record addressed by register 11 is to precede the record addressed by register 12 in the sorted output file. The condition code should be set to high if the opposite is the case. If the sequence of the two records in the sorted output file is arbitrary, the condition code should be set to equal. Record sequence own code must not alter either the records or the contents of any registers.

3.8. DATA REDUCTION

During each data pass of the sort process, the writing of a record is postponed until the next record to be written has been selected. The sort program then determines whether data reduction procedures are to be taken with respect to the two records. Data reduction procedures are taken if the two records:

- have equal values in all key fields, or
- cause record sequence own code to return control with an equal condition code.

3.8.1. Elimination

If the user wishes data reduction procedures to be the arbitrary elemination without subtotaling of one of the two records, the following keyword parameter should appear in a SORT statement:

EQUL=DELE

3.8.2. Own Code

If the user wishes to supply data reduction procedures as own code, the following keyword parameter must appear in a SORT statement:

DROC=label

where:

label — is the entry point to this data reduction own code. The sort program enters data reduction own code each time data reduction procedures are instituted.

At the time of entry, register 12 points to the record that is a candidate for elimination; register 11 points to the other record. The records may not be stored on half-word boundaries and must not be addressed by RX format instructions.

In the case of variable-length records, the 4-byte record length field is considered a part of the record.

When the two records are to be combined, data reduction own code effects this combination. The record length field of the record to be eliminated is then cleared to 0's. Instead of making a normal exit, control is transferred to the label DELE, which is defined as an externally referenced symbol in the data reduction own-code module. At DELE, the sort program eliminates 0-length record.

If data reduction own code determines that neither record is to be eliminated, the data reduction own code makes a normal exit. In any case, data reduction own code must not alter the contents of the key fields of any record that is to be retained; no alteration is to be made to the contents of any registers.

4. SORT PROGRAM OUTPUT

4.1. LABEL INFORMATION

The OLB statement must be used if it is desired to specify the values to be used in processing the header label of an output file at execution time of a UNIVAC 9200 II/9300/9300 II Magnetic Tape Sort (sort program). The format of the statement is:

LABEL	♭ OPERATION ♭	OPERAND
	OLB	f,c,g,v,x

where:

f Specifies the file identification.

c Specifies the creation date.

g Specifies the generation number.

v Specifies the volume number.

x Specifies the expiration date.

The specified values are stored in fields labeled OLBF, OLBC, OLBG, OLBV, and OLBX, respectively. Field OLBF is eight bytes in length; field OLBC, five bytes; field OLBG, four bytes; field OLBV, two bytes; and field OLBX, five bytes. The fields are found in main storage in the order listed; each of the dating constants OLBC and OLBX is preceded by a space. If an OLB statement is not presented to the sort program, the field OLBF contains the value:

SORTFILE

and fields OLBC, OLBG, OLBV, and OLBX will contain unsigned decimal 0's in unpacked format.

4.2. SORT CONTROL

If the sort program completely controls output, the output file is described in the operand field of the OUT statement in the form of keyword parameters. These parameters are similar to those used in a DTFMT (define the file for magnetic tape) macro instruction to describe an output file to the magnetic tape IOCS (input/output control system). The keyword parameters are defined here, and the differences between the use of parameters in the OUT statement and the DTFMT macro instruction are noted.

BKSZ=n

Whether the record format of the output file is fixed, variable, or undefined, a maximum block size must be specified for the file.

CKPT=YES

This keyword parameter is unique to the OUT statement. If it is included, and if the logical tape unit number specified for the output file is the same as that specified for a work tape, the sort program establishes a restart point at the beginning of each volume of the output file during a multicycle sort. The sort program records checkpoint information on each output file tape to establish this restart point.

CLRW=NORWD

The tape is not to be rewound after the output file is closed.

CLRW=RWD

The sort program assumes that the tape on which the file is recorded is to be rewound with interlock after the file is closed. If the tape is to be rewound without interlock after the file is closed, the keyword parameter, CLRW=RWD, must be included.

CRDT=label

If the user does not specify the location of the creation date, the sort program operates as if the specification were CRDT=OLBC.

DEVA=nn

The logical tape unit number specified for the output file may be the same as a logical tape unit number specified for a work tape or for the input file; however, the same logical tape unit number may not be specified for all three. If the logical tape number specified for the output file is the same as that specified for a work tape, it must be the logical unit number specified first in the TAPES statement.

FLBL=NO

The output file is unlabeled.

FLBL=NSTD

The output file contains nonstandard labels.

FLID=label

If the user does not specify the location of the output file identification, the sort program operates as though the specification were FLID=OLBF.

GENO=label

If the user does not specify the location of the generation number, the sort program operates as though the specification were GENO=OLBG.

LBAD=label

This keyword parameter is used when nonstandard labels are to be written on the output file. The user must define his own output area in which to build nonstandard labels for an output file, and label is the symbolic label of the first byte of a user routine designed to write the nonstandard labels.

OPRW=NORWD

The tape is not to be rewound before the output file is opened. Normally, the tape on which the output file is recorded is rewound without interlock before the file is opened.

RCFM=VARBLK

The record format for the output file is variable in length and blocked.

RCFM=VARUNB

The record format for the output file is variable in length and unblocked.

RCFM=UNDEF

The record format for the output file is undefined.

RCSZ=n

If the record format for the output file is fixed in length and blocked, n is the number of bytes in the record. For an output file with an undefined record format, n is the number (8–13) of a general register containing the record size.

TPMK=NO

This keyword parameter is used when a tape mark is not to be written following nonstandard header labels, at the beginning of an unlabeled file, or at the beginning of successive tapes in a multivolume unlabeled file. Otherwise tape marks are written automatically.

VOLN=label

If the user does not specify the location of the volume number, the sort program operates as though the specification were VOLN=OLBV.

XPDT=label

If the user does not specify the location of the expiration date, the sort program operates as though the specification were XPDT=OLBX.

When input label information is supplied by an ILB statement, the labels ILBF, ILBC, ILBG, and ILBV can be used to relate output label information to input label information. For example, if the output file is to have the same file identification as the input file, this is specified by including in the OUT statement the keyword parameter FLID=ILBF.

4.3. OWN-CODE CONTROL

If own code controls output from the sort program, none of the parameters described in 4.2 appear in the OUT statement. Instead, the following two keyword parameters appear in the OUT statement:

OPRO=label

where:

label is an entry point in the output procedure to which the sort program transfers control when it is ready to start delivering sorted records to the output procedure.

EOFA=label

where:

label is an entry point in the output procedure to which the sort program transfers control when there are no more sorted records to be delivered to the output procedure.

After the sort program transfers control to the OPRO label, the output procedure assumes complete initiative for the processing of sorted records. The output procedure obtains each sorted record by executing the imperative macro instruction:

```
LABEL     b OPERATION b     OPERAND                    b
1              10          16
          GET               SORT,workarea
```

The symbol SORT must be defined as an external reference in the output procedure. If the sorted record to be obtained from the sort program is fixed in length (not RCFM=VARBLK or VARUNB), it may be delivered to an area designated by register n by executing the instructions:

```
          STH               n,*+8
          GET               SORT
```

The STH instruction stores the record area address in the calling sequence generated by the GET macro instruction.

In response to the execution of a GET macro instruction, the sort program branches to the EOFA label when it determines that the sort operation is completed. The output procedure is terminated by executing the imperative macro instruction:

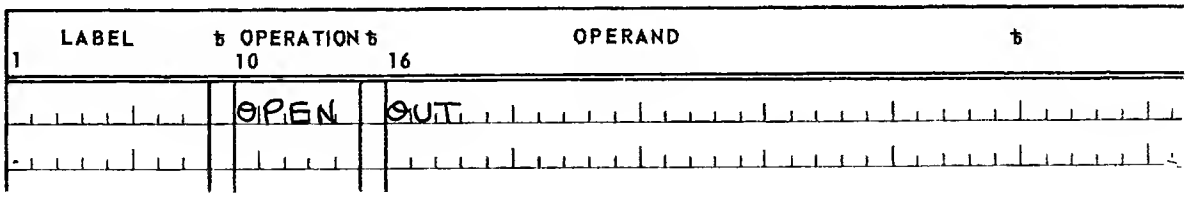
```
          CLOSE             SORT
```

4.4. COMBINED CONTROL

If own code controls output from the sort program but delegates the task of output file control, the parameters described in 4.2 and 4.3 appear in the OUT statement. In addition, either keyword parameter WORK=YES or the keyword parameter IORG=n must appear in the OUT statement, where they are used in the same way as in the DTFMT macro instruction.

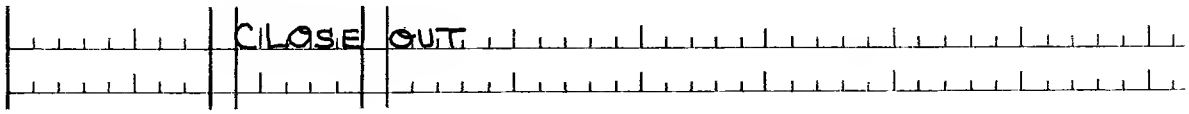
If the record format of the output file is variable in length and blocked, the keyword parameter WORK=YES must be specified. If the record format of the output file is variable in length and unblocked, the keyword parameter IORG=n also is permissible.

The output procedure opens the output file by executing the following imperative macro instruction:



The symbol OUT must be defined as an external reference in the output procedure.

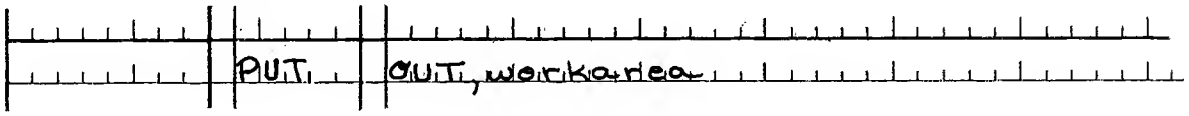
The output procedure delivers the next record to the output file by executing the imperative macro instruction:



The parameter workarea is optional.

Own code acquires records from the sort program as described in 4.3.

The output procedure closes the output file by executing the imperative macro instruction:



4.5. I/O PROCEDURE COMMUNICATION

If the input procedure has information to communicate to the output procedure and the two do not share memory, then the following keyword parameter should be included in a SORT statement:

RES=n

where:

n is the number of bytes of information to be communicated.

In response to this parameter, the sort program sets up an n byte area the first byte of which can be addressed by the externally defined label RES. Thus, the input procedure can put into the RES area information it wants to communicate to the output procedure. In such an instance, both the input procedure and the output procedure must declare the label RES as being externally referenced.

5. SINGLE AND MULTICYCLE SORTING

5.1. GENERAL

A UNIVAC 9200 II/9300/9300 II Magnetic Tape Sort (sort program) can be performed either in a single-cycle or a multicycle operation. The choice between single-cycle and multicycle operation depends upon the number of volumes of input data to be processed. If the input data exceeds one volume (reel), the sort will most likely require multicycle operation to process all the data. If the input data is a single volume, the sort will be able to process the data in a single-cycle (batch).

The sort program determines the tape capacity for each set of parameters given it. The variables affecting this computation are tape length, density, mode, and block size. The effects of the tape length and the density and mode are obvious. The effect of the sort block size is an inverse relationship so that the smaller the data block the greater the number of blocks and consequently the greater number of interblock gaps, which take tape space but contain no data. Therefore, if all the input data is accepted before the tape capacity is reached, the sort passes the data from the collation phase to the output routine, resulting in a single-cycle sort.

5.2. SETUP STAGE

During the setup stage the sort program performs the label checking and creation specified for the first and last work tapes, reads and processes all statement cards and own-code modules, and performs validity tests on the cards and modules. When a validity test fails, the appropriate message is displayed. If the error is detected during processing of statement cards, it is often possible for the sort program to continue validity testing by skipping the invalid parameter or statement. Checking for valid combinations of statements and parameters leads to a display requiring cancellation of the job in the setup stage.

5.3. SINGLE-CYCLE SORTING

A single-cycle tape sort is one that proceeds from the first operation to the last with all the data to be sorted contained within a batch. The size of a batch is that volume of data which can be contained on one sort work tape. The single-cycle sort computes the batch size and displays the end-batch signal (03FE) if the input data exceeds the batch size (A.5). The response to the end-batch display for a single-cycle is either to sort and output the batch as it is (the quantity accumulated) or to continue to accept input data until the end of file is detected. If the latter choice is made, the sort aborts if the data exceeds the tape capacity anywhere in the collation phase. When this happens, the user must re-initiate the sort program and call upon the multicycle operation.

5.3.1. Input Stage

During the input stage the sort program performs all operations required to reach the end of the input file. This includes specified label checking and handling of end-of-volume conditions. An additional operation is performed during the input stage if the logical unit number specified for the input file is also specified for a work tape or for the output file. Initially, all tape units must be provided with blank tapes to be used throughout the sort operation. When the tapes are examined and prepared, the last stated tape unit is compared with the tape unit given in the IN statement. If the tape unit is to handle the input file, the work tape is rewound with interlock and a MOUNT-INPUT is displayed. The operator then removes the work tape and mounts the input tape. When the START switch is pressed, the sort program begins accepting input records.

When the end of the input file is detected, the operation is dependent upon the further use of the input tape unit and upon the inclusion of the keyword parameter CLRW=NORWD in the IN statement. These operations are illustrated in Figure 5–1 and Figure 5–2.

	Input File Same As	
CLRW=NORWD	Work-Tape Unit	Output-File Unit
Absent	1a	1b
Present	1a	2

KEY	EXPLANATION
1a	When the end of the input file is detected, the last volume is rewound with interlock and a MOUNT-LIBRARY is displayed. The operator dismounts the input file and remounts the work tape removed prior to mounting the input file. Pressing the START switch causes the work tape to be verified and positioned.
1b	When the end of the input file is detected, the last volume is rewound with interlock. The operator demounts the input file and mounts a blank to be used during the output stage.
2	The remainder of the tape below the last volume of the input file is used by the sort program as a tape on which to record the output file if OPRW=NORWD in the OUT statement. If OPRW=NORWD is not in the OUT statement, the input tape is rewound, and the output file is recorded at the beginning of the tape, destroying the information there.

Operation 2 produces a faster tape sort than operation 1a; however, the sort program characteristically assumes that it has full tapes to use as work tapes. Consequently, it is possible that with operation 2 the sort program may decide that it cannot successfully conclude the process, in which case CANCL is displayed.

After all the data has been read from the input file, it is collated and the sort program enters the output state automatically.

A flow chart of the input stage of a single-cycle sort is illustrated in Figure 5–1.

5.3.2. Output Stage

During the output stage, the sort program performs any specified output file label operations and performs the final collation pass of the process to produce the output file. In both the card- and tape-oriented systems the sort program indicates completion of the process by executing an EOJ macro instruction.

5.4. MULTICYCLE SORTING

A multicycle sort operation permits completion of a tape sort that could not be executed successfully in a single-cycle operation. Multicycle sorting is requested by including the VOL parameter in the IN statement. This parameter indicates the number of volumes of the input file to be sorted and implies the production of more than one output volume.

A user with more than one volume of input who wishes to save on main storage allocation by using the single-cycle sort cannot use the VOL parameter to do so. He can, instead, provide an input procedure (IPRO) that determines the action to be performed on detecting end of file (EOFA). After closing the input file, a new volume can be mounted and the input file can be reopened.

The use of a PART statement also implies multicycle sorting and causes its selection and loading whether or not a VOL parameter is included in the IN statement.

5.4.1. Input Stage

The sort program counts data records accepted during the input stage. When the count reaches the calculated limit of data that can be written on a tape sort work tape as an ordered subfield, the sort program displays a CHOOSE message. For multicycle sorting, the normal response is to press START to continue. For single-cycle sorting, however, all the input data should be delivered to the sort program. By making a keyin response, then pressing the START switch, the operator can instruct the sort program to ignore the fact that the input record count has reached the cycle limit (5.5.2.1). The sort program continues to accept data until the end-of-file sentinel is detected and may go through to successful completion. However, the sort program also may be unable to complete the sort process in a single-cycle mode successfully. In this case, a tape runoff could occur, indicated by a tape dispatcher error message.

In multicycle sorting, the operator may decide to reply to the CHOOSE display if, at that point, the input file is nearly exhausted so that the remaining data can still be included in the subfile.

The steps in a cycle of multicycle sorting vary depending on whether the logical tape unit specified for the input file is the same as a logical unit number specified for a work tape.

5.4.2. Input File and Separate Work Tape

A multicycle tape sort operating with an input file and a separate work tape is described in the following paragraphs. (See Figure 5–2.)

5.4.2.1. FIRST AND INTERMEDIATE CYCLES

When the operator presses the START switch after seeing the CHOOSE display, the sort program collates the data read from the input file until all the data is written on a single work tape, which constitutes an ordered subfile. (If the logical tape unit number specified for the output file is the same as a logical unit number specified for a work tape, the ordered subfile is produced on the work tape.)

After the ordered subfile is written, it is rewound with interlock and a SUBFILE is displayed. The SUBFILE display includes the number of the ordered subfile just rewound with interlock; pressing the START switch displays the volume number, which is 0 in the input stage. The first subfile produced is numbered 1, the second subfile is numbered 2, the third is numbered 3, and so on. After the SUBFILE-VOLUME displays, the operator dismounts the ordered subfile and physically labels it with its subfile number. He then mounts a blank tape in place of the dismounted ordered subfile and presses the START switch. Any label checking and creation date specified for work tapes is done with respect to the blank tape. The sort program then accepts input records until the input record count once more reaches the cycle limit, at which point control is returned to the cycle point.

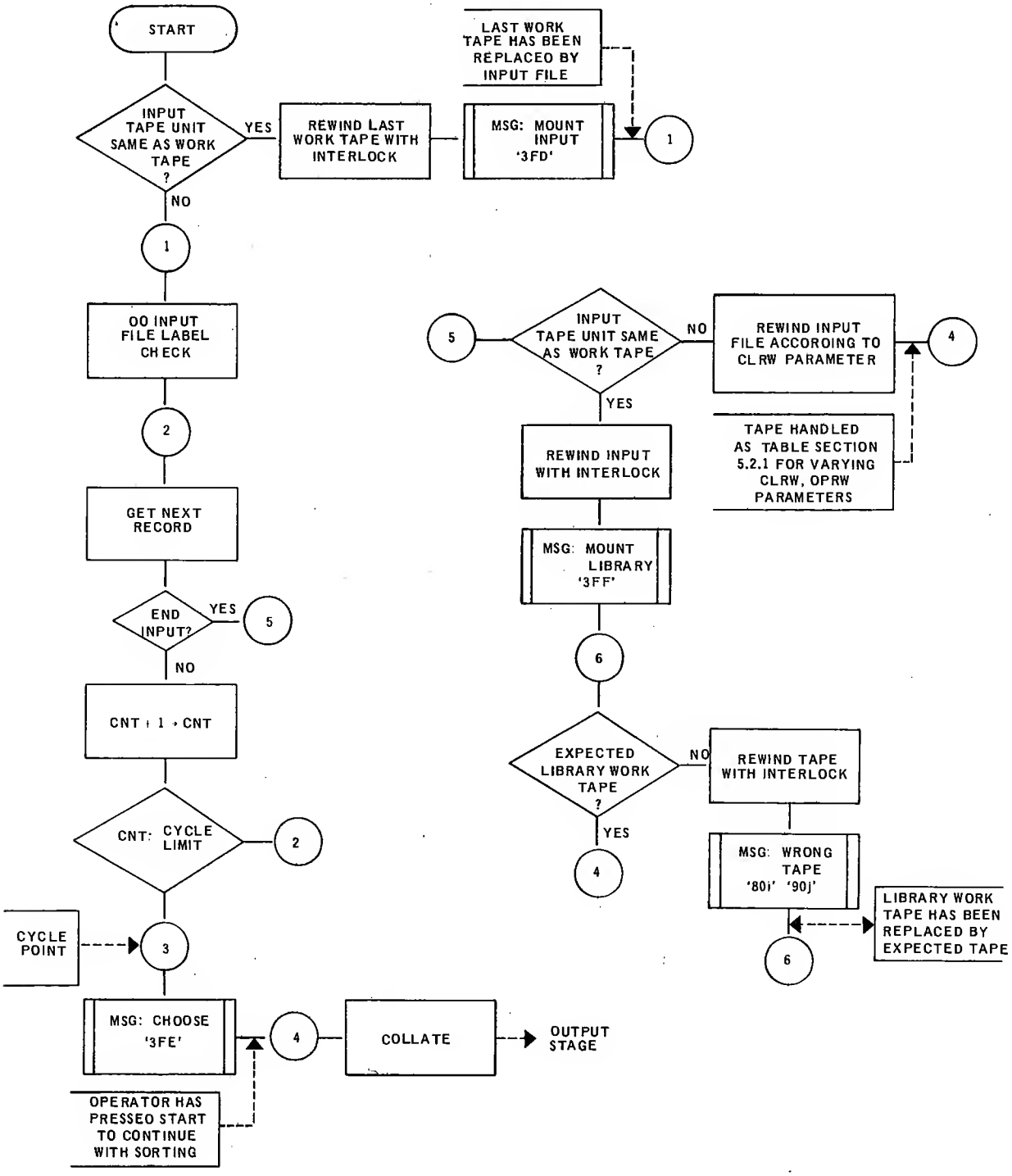
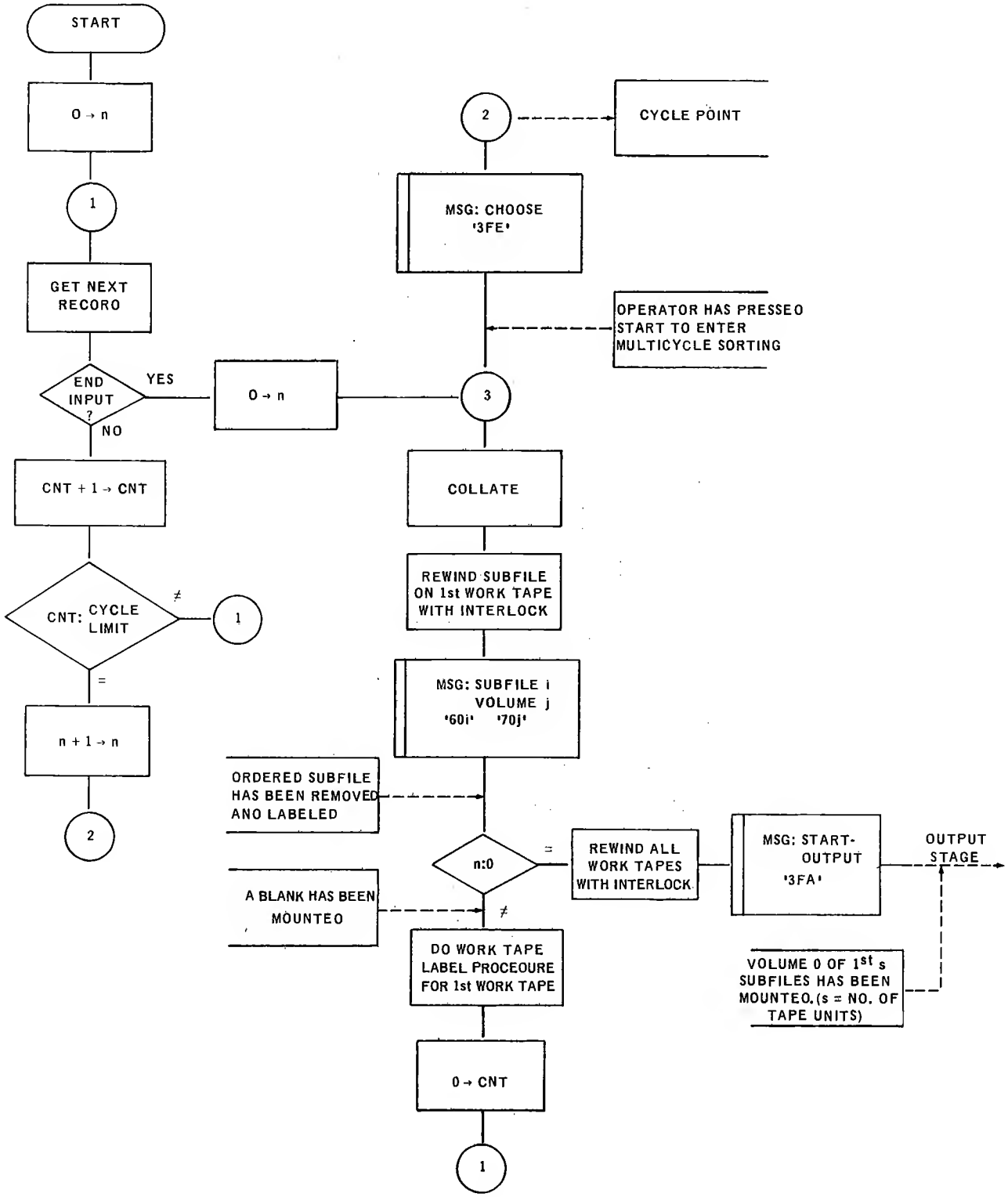


Figure 5–1. Single-Cycle Tape Sort Input Stage



NOTE:

n = i = SUBFILE number
j = VOLUME number

Figure 5–2. Separate Input and Work Tape File with Multicycle Tape Sort

5.4.2.2. LAST CYCLE

When the end of the input file is detected before the input record count reaches the cycle limit, the sort program produces the last ordered subfile from the data read. The SUBFILE display for the last ordered subfile indicates that the ordered subfile number is 0. When the operator presses the START switch after the SUBFILE-VOLUME displays, all work tapes are rewound with interlock and a START-OUTPUT is displayed. When the START switch is pressed, the sort program enters the output stage.

5.4.3. Input File Same as Work Tape

During the setup stage, the tape unit, which the input file shares with the work tape, is initially provided with a blank tape on which a tape sort library is to be created. At completion of the setup stage, the library work tape is rewound and a MOUNT-INPUT display indicates that the input tape is to be mounted. The operator presses the START switch to begin the input stage.

5.4.3.1. FIRST AND INTERMEDIATE CYCLES

After the cycle point CHOOSE display, the sort program rewinds the current volume of the input file with interlock and displays a MOUNT-LIBRARY. The operator replaces the current volume of the input file with the previous library work tape. If a tape other than the expected library work tape is mounted, the tape is rewound with interlock and a WRONG-TAPE is displayed. (The subfile and volume numbers are not significant.) The operator must then replace the rewound tape with the expected tape and press the START switch. The label is checked again and, if valid, the collation overlay is loaded from this tape. The sort program then proceeds to produce the next ordered subfile.

When the subfile is completed, the SUBFILE display indicates its number; pressing the START switch displays the VOLUME number. The ordered subfile volume is removed, labeled, and replaced with a blank tape by the operator. The operator then presses the START switch and the work tape sharing a tape unit with the input file is rewound with interlock. The MOUNT-INPUT display indicates that the library work tape is to be replaced by the current volume of the input file. Pressing the START switch causes the input file label to be rechecked and the tape to be positioned at the last cycle point. The sort program then begins dispersion of data for the current cycle of the input stage.

5.4.3.2. LAST CYCLE

At the end of the input file no special display is made. The end of the input stage is indicated by the production of subfile 0, followed by the START-OUTPUT display.

5.4.3.3. INPUT LABEL CHECKING

Each time the current volume of the input file is replaced with the work tape on their common tape unit, the label of the current volume is checked before it is repositioned. With one exception, the label check processing is the same as that performed when a new volume of the input file is opened. An input label check characteristically involves two steps:

1. The anticipated value of the volume file header label is calculated on the basis of the value of the preceding volume file header label. For example, in the standard input label check routine, this calculation takes the form of increasing the volume number by 1.

2. The volume file header label is inspected to determine that its value agrees with the anticipated value.

Step two is usually programmed to be repeatable so that when a tape fails a label check and is replaced by another tape the label check can be made with respect to the newly mounted tape. In summary, a check of an input volume file header consists of step one followed by step two. A recheck of an input volume file header consists of step two alone.

Using the preceding terms, label checking of the remounted input file volume is a recheck rather than a check.

Checking and rechecking are automatic functions of the standard input label check routine. If an own-code input label check routine is provided, the sort program transfers control to the LBAD label for a check and to the LBRC label for a recheck. If the LBRC label is not specified, control is transferred to the LBAD label for both a check and a recheck.

A flowchart of the input stage of a multicycle tape sort in which the input file and a work tape share a tape unit is illustrated in Figure 5–3.

5.4.4. Output Stage

During the output stage, the operator remounts the ordered subfiles produced by the sort program. In all other respects, the output stage of a multicycle sort is the same as the output stage of a single-cycle tape sort.

The ordered subfiles are mounted in order by subfile number on the tape units in the order in which the logical tape unit numbers are listed in the TAPES statement.

The output stage consists of merging ordered subfiles to produce the output file. If the number of subfiles is less than the number of work tapes, the process is completed with one merge. In all other cases, more than one merge is necessary.

During a multimerge output stage, the output file is produced during the final merge. Each other merge produces an ordered subfile, which must be demounted then remounted as input to a subsequent merge.

The numbering of subfiles during the output stage is carried over from the input stage. Thus, if the highest subfile number assigned to a subfile by the input stage is n, the first subfile produced by the output stage is numbered n+1, the second subfile is numbered n+2, the third is numbered n+3, and so on.

Subfiles produced during the input stage are one volume long; those produced during the output stage may be more than one volume long. Consequently, during the output stage the VOLUME display following a SUBFILE display is incremented to show the volume number of the tape in its subfile. The output stage produces ordered subfiles on the same work tape as the input stage.

The sort program indicates when a volume of an input ordered subfile is to be demounted and replaced by rewinding the volume with interlock. Inasmuch as the order in which input subfile volumes are to be mounted and the logical tape units on which the volumes are to be mounted are known, the sort program knows at all times what volume should be on a tape unit. Each time an input-ordered subfile volume is mounted, the tape sort examines the tape to verify that it is the right volume. Because the sort program produces all volumes of all subfiles, this verification is completely under tape sort control and is independent of the work tape labeling procedure specified by the user. If the tape does not pass verification, it is rewound with interlock, and a WRONG-TAPE is displayed. The WRONG-TAPE display also indicates subfile and volume numbers of the proper volume. The operator should then mount the indicated volume and press the START switch. The sort program then examines the newly mounted tape to verify that it is the expected volume.

To optimize output stage efficiency, the first merge might not use all available work tape areas. This does not affect tape mounting procedure. Once mounted, an input-ordered subfile volume should remain mounted until rewound with interlock.

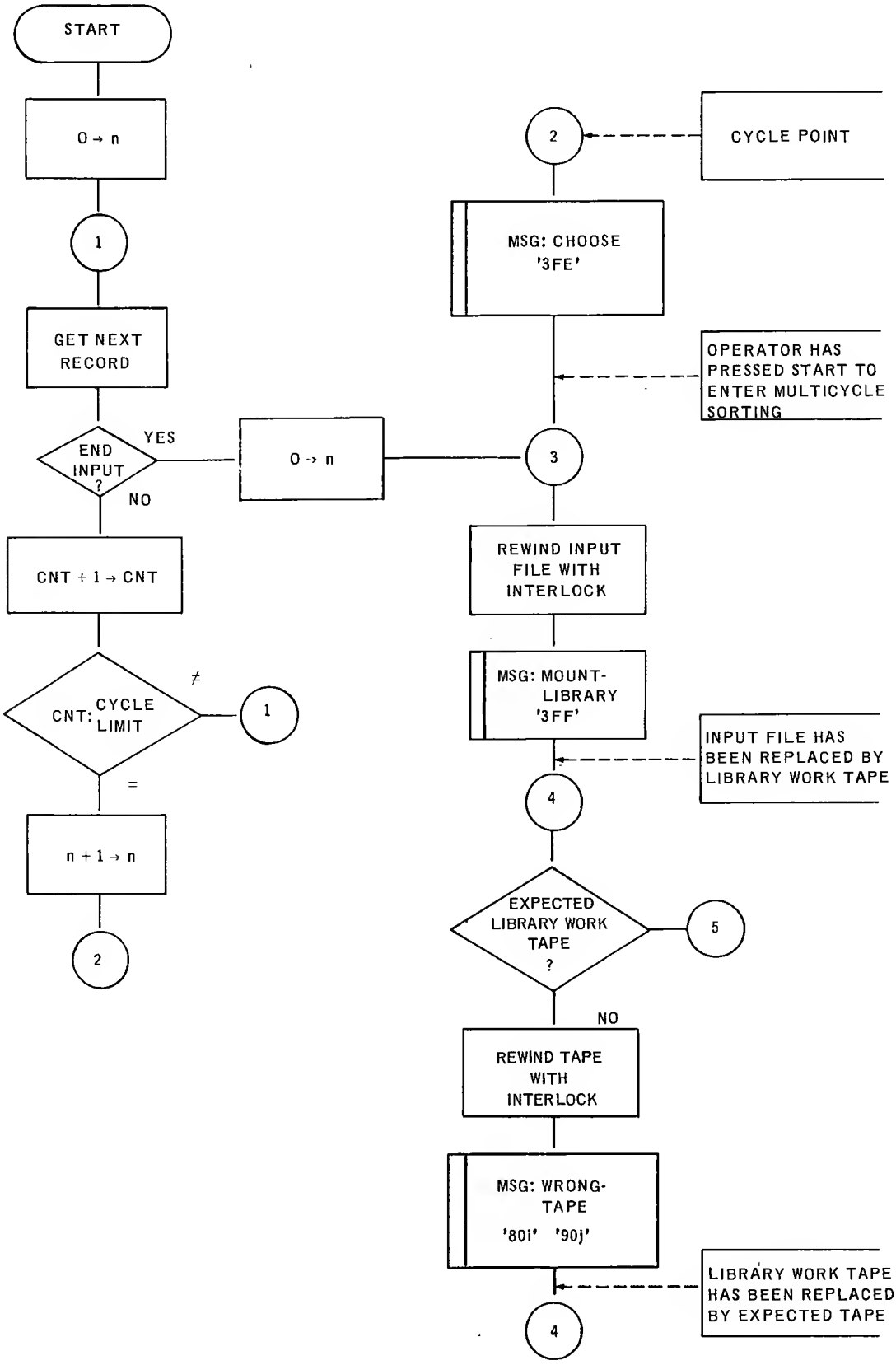
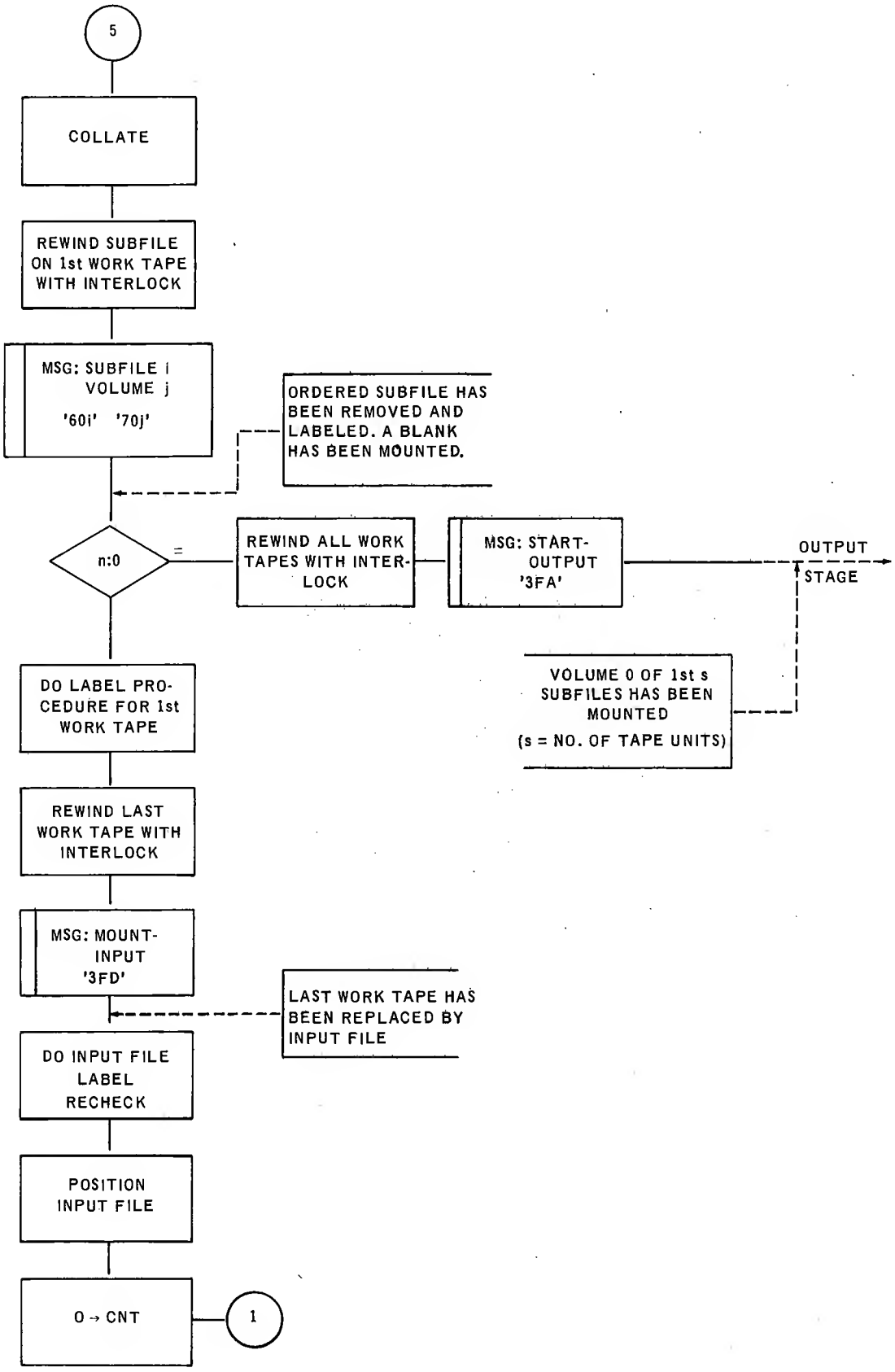


Figure 5–3. Common Input and Work Tape File with Multicycle Tape Sort (Part 1 of 2)



NOTE:

n = i = SUBFILE number
j = VOLUME number

Figure 5–3. Common Input and Work Tape File with Multicycle Tape Sort (Part 2 of 2)

The following is an example of a multimerge output stage:

The sort program has been allocated four work tapes by the following TAPES statement.

LABEL (1)	OPERATION (10)	OPERAND (16)
	TAPES	01,02,03,04

The logical tape unit number one also has been allocated to the output file by inclusion of the following keyword parameter specification in the OUT statement:

DEVA=01

The input stage produces six ordered subfiles, which are numbered 0 through 5.

In this example, the output stage consists of three merges (Figure 5–4). The operator mounts ordered subfiles 0, 1, and 2 on tape units 2, 3, and 4. The first merge reads subfiles 0 and 1 and produces subfile 6, which is two volumes long. The operator replaces subfiles 0 and 1 with subfiles 3 and 4. The second merge reads subfiles 2, 3, and 4 and produces subfile 7, which is 3 volumes long. The operator then mounts subfile 5 and volume 1 of subfiles 6 and 7. The final merge then begins. During the remainder of the output stage, volume 1 of subfile 6 rewinds with interlock and should be replaced by volume 2; volume 1 of subfile 7 rewinds with interlock to be replaced by volume 2; subsequently, volume 2 rewinds with interlock to be replaced by volume 3.

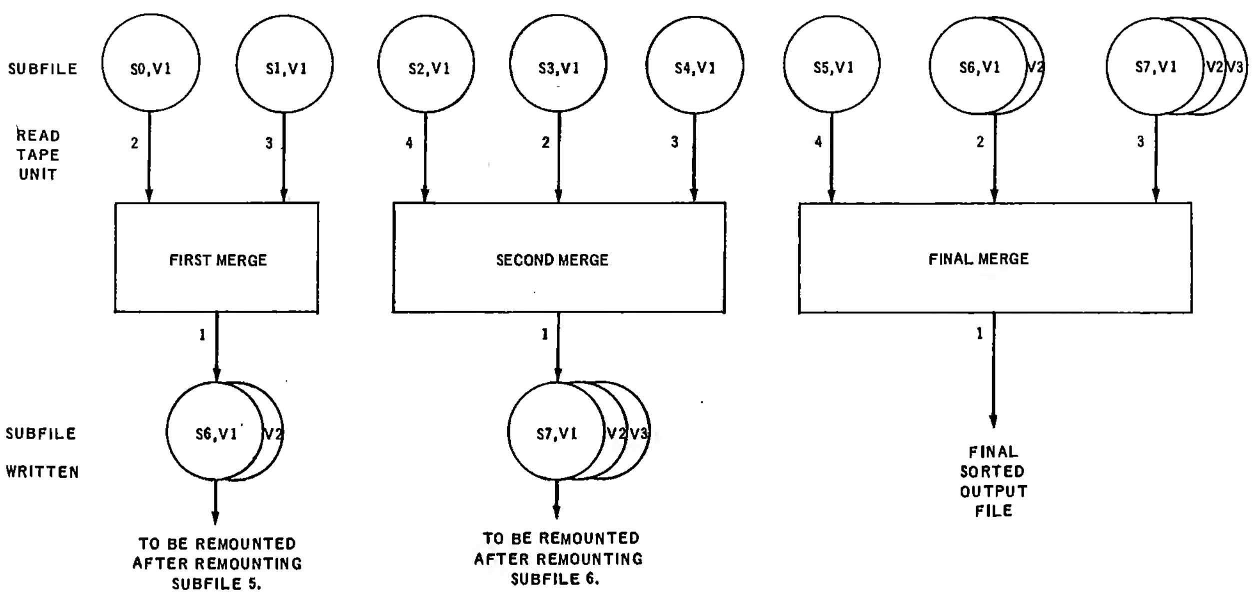


Figure 5–4. Multimerge Output Stage With Three Merges

5.5. OPERATING PROCEDURE

The preceding example illustrates the following rules for operating a multicycle tape sort.

1. Ordered subfiles are always produced on the same logical tape unit.

2. After a subfile has been produced, it is demounted, labeled with its subfile and volume numbers, and replaced by a new work tape.

3. Subfiles are numbered sequentially in the order that they are produced with the single exception that the last subfile produced by the input stage is numbered 0.

4. Each subfile is remounted as an input only once.

5. Subfiles are remounted by subfile number.

6. The logical tape units on which consecutive subfiles are mounted are themselves in a fixed order. (In the example, the order is 2, 3, 4, 2, 3, 4, 2, 3.)

7. When the highest-numbered subfile produced thus far is remounted as an input, the final merge of the output stage begins.

5.6. RESTART PROCEDURES

A restart procedure is performed through checkpoint dumps on tape. Each checkpoint actually consists of two checkpoint dumps, one at the end of a tape produced by the sort program, and the other at the beginning of the next tape produced by the sort program.

5.6.1. Establishing a Checkpoint

The sort program establishes a checkpoint by writing a checkpoint dump on a tape. With the single exception of the first ordered subfile produced, the checkpoint dump is written on each volume of each ordered subfile. It is also written on each volume of the output file if the conditions described with respect to the specification of the CKPT keyword parameter in the OUT statement are satisfied. The checkpoint dump is written as soon as the blank tape on which the volume is to be written has been processed by the specified label procedure. As part of establishing a checkpoint, the sort program also writes a checkpoint dump on each volume of each ordered subfile and, if appropriate, on each volume of the output file just before rewinding the volume with interlock.

At each checkpoint, the operator should make a record of the tapes. (From the point of view of making this record, the operator can consider the checkpoint to be the point at which the just-produced volume of the current ordered subfile is rewound with interlock.)

During input stage, the record shows:

1. The current volume of the input file if the input file is described in the IN statement.

2. The ordered subfile just produced (referred to as the previous dump tape).

3. The work tape that is to replace the ordered subfile just produced (referred to as the current dump tape).

During the output stage, the record shows:

1. The current volume of each input-ordered subfile.
2. The ordered subfile or output file volume just produced (referred to as the previous dump tape).
3. The blank tape that replaces the ordered subfile or output file volume just produced (referred to as the current dump tape).

During a restart, the sort program can restore to its state at the checkpoint only those tapes mounted on logical tape units specified in the TAPES statement and DEVA keyword parameters of the IN and OUT statements. If the input and/or output procedure controls any files other than those recorded on these tapes, the operator must make a record of the state of these other files at each checkpoint.

During the input stage, the state of such a file remains static during the time lapse between the cycle point and the checkpoint for which a record of that state is required. Thus, the operator can save time by recording this file state in anticipation of the need in the future.

5.6.2. Restart From a Checkpoint

The checkpoint from which restart is to be made is determined and the operator is directed to a particular set of information that he recorded at that checkpoint. On the basis of this information, he mounts the following tapes.

- During input stage, input file on separate tape unit:
  - current dump tape
  - current input file volume
- During input stage, input file and work tape sharing tape unit:
  - current dump tape
  - blank, which becomes a sort library
- During output stage:
  - current dump tape
  - current volume of each input-ordered subfile

If there are any special files that the sort program cannot restore to checkpoint state, the operator must follow a user-developed procedure to restore them to their checkpoint state. If restart is performed during the input stage, the operator must also mount work tapes on all work-tape units other than the work-tape unit on which the current dump tape is mounted; however, these work tapes do not need to be the same physical tapes present on the work tape units when the checkpoint was established. The only difference between restarting the sort program or initially starting it is the inclusion of one more card in the statement deck. This is the RSTRT statement, which has the following form:

LABEL	b OPERATION b	OPERAND
	RSTRT	p

where:

p may have several different values.

1. If p is SAME, the sort program reuses the current dump tape to write the next volume of the ordered subfile or output file.

2. If p is NEW, the sort program restarts from the checkpoint dump on the current dump tape. The sort program then rewinds the dump tape with interlock, displays a SUBFILE and VOLUME of the previous subfile, and expects a blank tape to be mounted for its use. If the input file shares a tape with a work tape, the last work tape (now containing a tape sort library) is rewound with interlock, and the input file requested.

3. If it proves impossible to read the checkpoint dump on the current dump tape, it should be replaced by the previous dump tape. The parameter p should then have the value NEXT. In this case, the sort program locates the checkpoint dump at the end of this dump tape, reestablishes itself from this dump, rewinds this tape with interlock, and makes a SUBFILE, VOLUME display of the previous subfile. The sort program then expects a blank tape to be mounted for its use. If the input file shares a tape unit with a work tape, the last work tape (now containing a tape sort library) is rewound with interlock and the input file is requested.

   After reestablishing itself, the sort program verifies that correct or acceptable tapes have been mounted on all logical tape units before restarting.

   If the input file and a work tape share a logical tape unit, a blank tape may be provided for the work tape when restart is executed; however, after being chosen, the same work tape must be used to replace the input file for the remainder of the input stage of the restarted sort process.

5.6.2.1. CHECKPOINT FREQUENCY

During input stage, the number of checkpoints established is equal to the number of times the input record count reaches the cycle limit. Unless otherwise instructed, the sort program establishes the cycle limit as the number of records that can be written on a full work tape.

If the user wishes checkpoints established more frequently, he may reduce the cycle limit by specifying, in a SORT statement, the keyword parameter:

CYCL=n

where:

n is used to determine the cycle limit and is the length in feet of tape that the tape sort is to use as a maximum on a work tape reel.

5.6.2.2. RESTART FROM AN INTERRUPTION

If the sort program is interrupted by an unsolicited keyin, it can be restarted at the point of interruption by:

1. Remounting on the same logical tape units the tapes that were mounted on these units when the tape sort was interrupted, including work tapes and input and output file tapes.

2. Initiating restart procedures with a RSTRT statement and no operand.

5.7. SEGMENTED SORTING

The sort program can be directed to perform only one stage of the sort process with a PART statement. The first parameter of the PART statement is a keyword parameter and is INPUT if only the input stage is to be performed and OUTPUT if only the output stage is to be performed. In both cases, the PART statement also must include the keyword parameter:

SUB=n

where:

n is the subfile number the sort program assigns to the first ordered subfile it produces. The consecutive assignment of subfile numbers to subfiles then resumes from the specified subfile number. If the sort process is to be segmented, communication between input and output procedures via the RES area is impossible.

5.7.1. Input Stage

The last ordered subfile produced by segmented running of the input stage is not assigned subfile number 0. It is assigned a subfile number in consecutive order in the same way that other subfiles are assigned numbers.

If an input procedure contains an end-of-file entry point, the sort program makes an end-of-file return when it reaches the end of the input file for this segment. When the operator presses the START switch in response to the START-OUTPUT display, the tape sort goes to EOJ. If the user wishes to control detection of end-of-input file, a VOL keyword parameter can be included in the PART statement rather than in the IN statement.

5.7.2. Output Stage

A segmented output stage merges a set of ordered subfiles numbered in unbroken sequence. A PART statement introduced to a segmented output stage must include the two keyword parameters:

SUBS=s

and

SUBG=g

where:

s is the smallest subfile number in the subfile number sequence, and g is the highest number in the subfile number sequence.

A segmented output stage starts with a START-OUTPUT display. It normally goes to EOJ after merging the given input ordered subfiles into one ordered subfile. If, however, the user desires the segmented output stage to produce the final sorted output file, the following keyword parameter specification must be included in the PART statement:

TERM=FINAL

5.7.3. Restarting

When a sort program is run in parts, the restart procedure for each part is the same as the restart procedure for a tape sort that has not been segmented. Thus, if one part of a segmented tape sort has produced subfiles n through n + i, restart procedures can be used to reproduce subfile n + 1, n + 2, n + 3, ... or n + i; to reproduce subfile n, PART must be initiated from the beginning of the run, without a RSTRT statement.

APPENDIX A. SUMMARY OF SORT OPERATING PROCEDURES

A.1. GENERAL

Three versions of the UNIVAC 9300 Magnetic Tape Sort (sort program) are available.

- Card system

  Minimum operating system (MOS) with card reader

- Card system

  MOS with card controller

- Tape system

  Nonconcurrent operating system (NCOS), concurrent operating system (COS), with control stream

A.2. TAPE SORT INPUT DECKS

Figures A–1 and A–2 show the required input for the card and tape systems, respectively. In either system the user must supply at least the minimum set of SORT statements (deck B) plus three PHASE END cards. Figure A–3 shows the MOS: sort input deck, using an 8K memory.

In the card system, the SORT statements and END statements are inserted as shown in the self-loading sort deck. In the tape system these are the data cards of the control stream. Optional additions are described in Appendixes B and C.

A.3. MINIMUM SET OF SORT STATEMENTS

Deck B must contain the following cards:

- Multicycle

  IN BKSZ=n_1,RCSZ=n_2,DEVA=n_3VOL=n_4

  OUT BKSZ=n_5,RCSZ=n_6,DEVA=n_7

  FIELD P_1,n_8

  TAPES P_2,P_3,P_4

  END

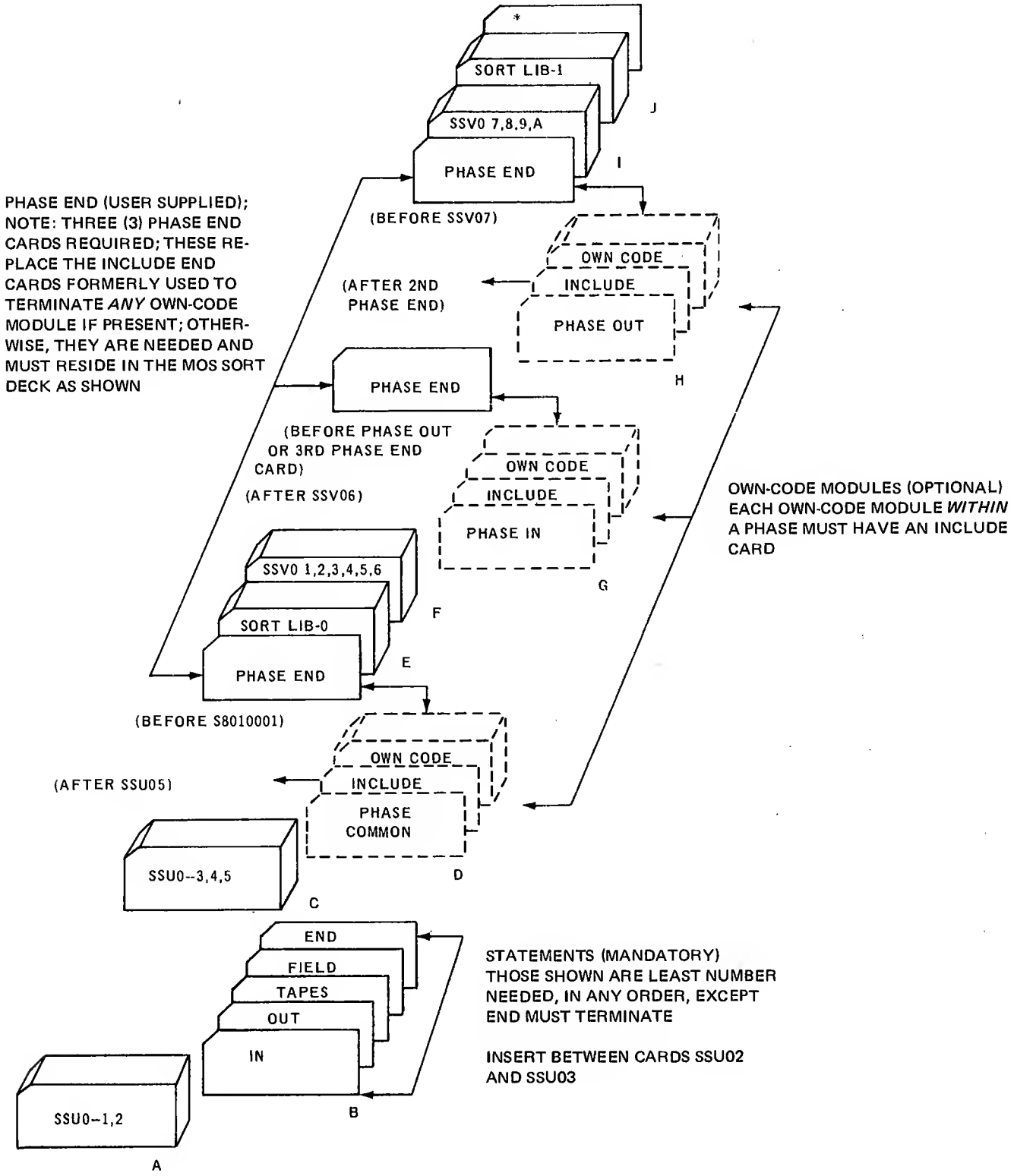


Figure A–1. MOS: Tape Sort Input Deck, Card Reader, Card Controller

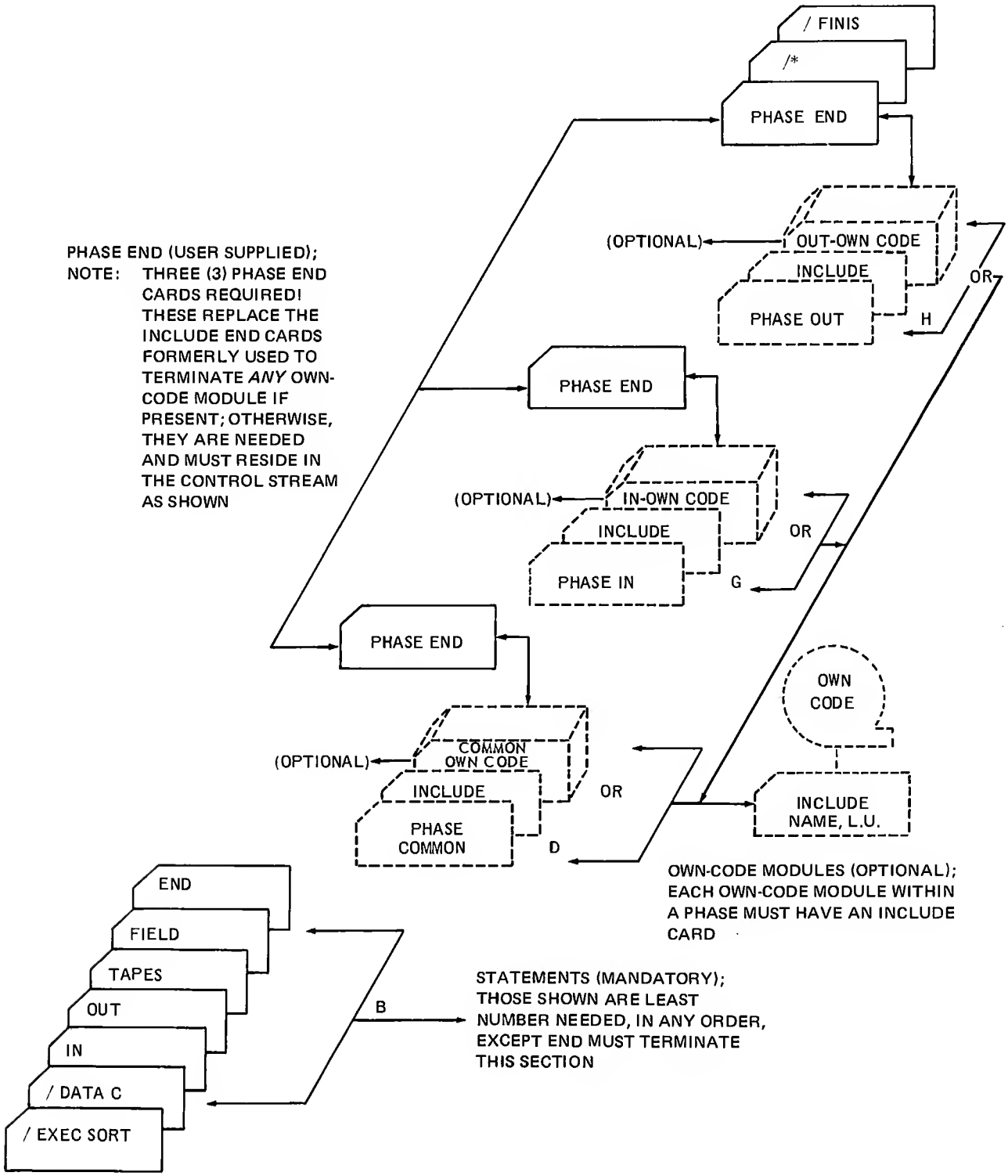
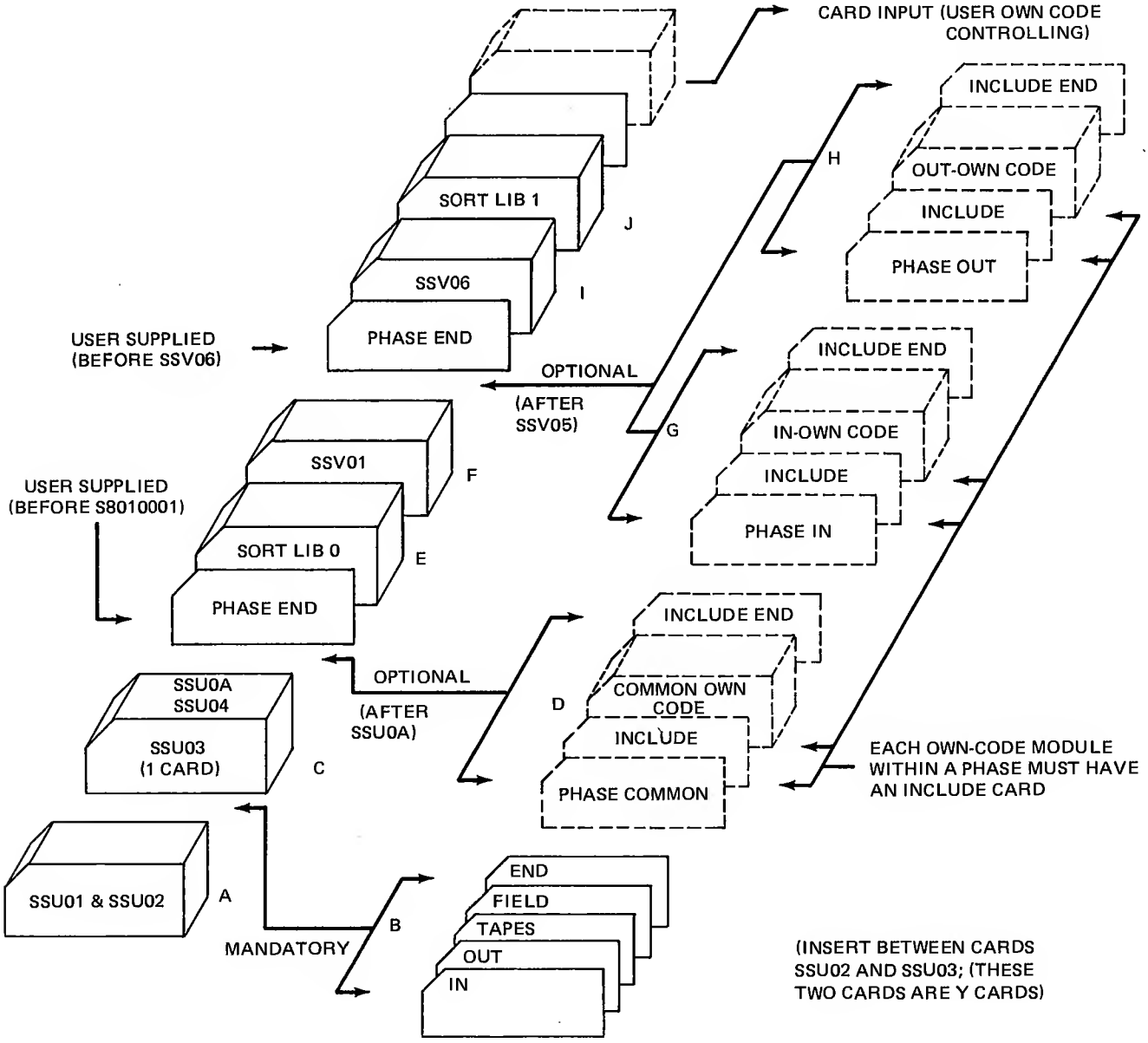


Figure A–2. NCOS, COS Tape Sort Input Deck Control Stream



NOTE:

——— MANDATORY
– – – – – OPTIONAL

Figure A–3. MOS: Tape Sort Input Deck, Using 8K Memory

The cards may be in any order, except that the END statement is the last.

- Single Cycle

  IN BKSZ=n_1,RCSZ=n_2,DEVA=n_3,VOL=n_4

  OUT BKSZ=n_5,RCSZ=n_6,DEVA=n_7

  FIELD P_1,n_8

  TAPES P_2,P_3,P_4

  END

  Use the same set of statements as for multicycle, but omit the VOL=n_4 parameter from the IN statement.

A.4. OPERATING PROCEDURE

The standard operation of the sort program is summarized in the following paragraphs. Details and flowcharts are included in Section 5. Standard operating displays are included in A.5; error displays are shown in Appendix E.

A.4.1. Setup Stage Procedure

1. Mount input file if it does not share a tape unit.
2. Mount acceptable work tapes on all tape units.

(If a tape library is the source of own-code elements, it may be mounted on any but the first or last tape unit, and may be replaced prior to dispersion.)

- For Card Operation

  1. Load supervisor from appropriate unit.
  2. Place sort deck in appropriate unit, and initial load.

- For Tape Operation

  1. Place sort deck in control stream reader.
  2. Mount the systems tape on logical unit 0 and initial load.
  3. Press START switch; replace work tape with input file when requested if they share a unit.

A.4.2. Input Stage Procedure

1. Sort makes CHOOSE display.
2. Reply None, to proceed.
3. Reply 1, to force acceptance of more data.

- Single cycle

  1. Output file is produced on specified unit: demount and label it.

  2. EOJ message is displayed.

- Multicycle

  1. Successive SUBFILEs, all with one VOLUME, are produced on first-named tape unit; label and demount; replace with work tape.

  2. Recycle to first step of input stage procedure until SUBFILE 0 is produced; demount and label it; proceed to next step of output stop procedure.

A.4.3. Output Stage Procedure

- Multicycle

  1. Sort makes START-OUTPUT display. Demount all work tapes; mount work tape on first unit specified in TAPES statement; mount SUBFILE 0 to second unit, SUBFILES 1 to 3, and so forth.

  2. Press START switch.

  3. Sort makes $SUBFILE_i$ $VOLUME_j$ display. Demount and label new subfile volume from first unit. Replace with work tape. Record checkpoint subfiles and volumes (5.5.1). Repeat the last two steps, mounting all volumes of a subfile to the same unit. As the last volume is exhausted, mount the next numbered subfile to the freed unit.

  4. Final output file is produced when the highest-numbered subfile is mounted; demount and label output file volumes as they are written on the DEVA specified in the OUT statement.

  5. The EOJ message is displayed.

A.4.4. Restart Procedure

- Input Stage

  1. Add the RSTRT p statement to deck B.

  2. Remount the input file unless it shares a unit; remount the appropriate dump tape to first unit; mount work tapes on all other sort units.

  3. Follow setup stage procedures in second step.

- Output Stage

  1. Add the RSTRT p statement to deck B. (For RSTRT p in the output stage of the card system only, deck J (SORT LIB 1) may be removed from the input, the /* card then following card SSVOAzzz.)

  2. Remount the appropriate dump tape to first unit; remount all volumes of all subfiles listed in the operator record for this checkpoint.

  3. Follow setup stage procedures in second step.

A.4.5. Jettison Procedure

- All Stages

  1. Set data entry switches to 0F.
  2. Press operator request; memory dump is executed on first unit of TAPE statement; all tapes are rewound with interlock.
  3. Record logical units for all tapes.

A.4.6. Restart After Jettison

- All Stages

  1. Add RSTRT card to deck B.
  2. Remount all tapes on previous logical units.
  3. Follow setup stage procedure of second step.

A.5. TAPE SORT STANDARD OPERATING DISPLAYS

Display	Reason	Action
3FE	CHOOSE	End of a batch of input data; reply 1 to force acceptance of more data; no reply to continue sorting.
3FD	MOUNT-INPUT	Replace work tape on last unit with the input file.
3FF	MOUNT-LIBRARY	Replace the input file with the library work tape.
3FA	START-OUTPUT	Program is about to enter the output stage; if PART INPUT is being executed, part sorting is complete.
60i	$SUBFILE_i$	Subfile number i has been completed.
70j	$VOLUME_j$	Volume number j has been completed.
80i 90j	WRONG-TAPE	In input stage, i and j are not significant; in output stage, i and j indicate the number of the required SUBFILE and VOLUME.

APPENDIX B. SUMMARY OF SORT STATEMENTS AND OPERANDS

B.1. GENERAL

The statements and options used by the sort program are summarized in Table B–1. The SORT, IN, and OUT statements are combined because they have many parameters in common. The column, Required, indicates parameters required by the sort program; no checks are in this column for the SORT statement because the SORT statement is optional. The remaining statements containing parameters not common to each other are described in parts 4 and 5 of Table B–2.

Statement			Key Word	Specification	Required	Remarks
Sort	In	Out				
	X	X	BKSZ	n=maximum block size	√	For IN and OUT; sort program block size is computed during the setup stage
	X		CKPT ①	YES		Bypass checkpoint dumps on input files; the output tape cannot be inputted to TRPG using this keyword
	X	X	CLRW	NORWD		No tape rewind after CLOSE
				RWD		Rewind tape without interlock after CLOSE
X	X	X	CRDT ①			For standard label checking; address of the creation date area
X			CYCL ①	n=length of work tape, in feet		To establish checkpoint more frequently than at cycle limit
	X	X	DEVA	n=logical unit	√	Logical tape unit number
X			DROC	Symbolic label		Address of user record sequence own code
	X	X	EOFA	Symbolic label		Address of user end of file own code; required for combined control of IN file or own code control of OUT file.

① Not available on 8K sort.

Table B–1. Sort Statements With Common Parameters (Part 1 of 3)

Statement			Key Word	Specification	Required	Remarks
Sort	In	Out				
	X		ERRO	IGNORE		Treat error block in IN file normally.
				SKIP		Skip block containing error
				Symbolic label		Address of user error-handling own code
X			EQUL	DELE		Sort program eliminates duplicate record
X	X	X	FLID ①	Symbolic label		For standard label checking; address of file identification area
X	X	X	FLBL	NO		For unlabeled files
				NSTD		For nonstandard labeled files
X	X	X	GENO	Symbolic label		For standard label checking; address of generation number area
	X		IPRO	Symbolic label		Address of user input procedure own code; required for combined or own code control of IN file
	X	X	IORG	n=general register 8–13		For records processed in I/O area with an alternate I/O area, or blocked records, or variable-length or undefined records read backward
X	X	X	LBAD ①	Symbolic label		Address of user label routine; required for OUT or SORT with nonstandard labels, or for IN file with nonstandard checked labels, or for IN file with no tapemarks following header labels
	X		LBRC ①	Symbolic label		Address of user label recheck coding; required for IN or SORT files with LBAD
		X	OPRO	Symbolic label		Address of user output procedure own code; required for combined or own code control of OUT file
	X	X	OPRW	NORWD		No tape rewind before OPEN
X			RCFM ①	VAR		For variable sort program record size
	X	X	RCFM ①	VARBLK		Record format is variable and blocked
				VARUNB		Record format is variable and unblocked
				UNDEF		Record format is undefined

① Not available on 8K sort.

Table B–1. Sort Statements With Common Parameters (Part 2 of 3)

Statements			Key Word	Specification	Required	Remarks
Sort	In	Out				
X			RCSZ	n=record length		If RCFM=VAR, n is the maximum length; if not stated, obtained from IN statement
	X	X	RCSZ	n=record length	√	Required for IN and OUT
				n=general register 8–13	√	For undefined record format, in IN or OUT
	X		READ ①	BACK		IN file is read backward
X			RES ①	n=area length		To reserve a communication area in common memory which both IN and OUT may address
X			STOR ①	n=maximum address		To restrict amount of memory to be used by the sort program
X			TAPE ①	n=length of work tape, in feet		To shorten sort work tape length
		X	TPMK	NO		No tape mark is written after nonstandard header label or before an unlabeled file
	X		VOL ①	n=number of volumes		End-of-file action is taken after reading n volumes of IN file; required for multicycle sorting
X	X	X	VOLN ①	Symbolic label		For standard label checking; address of volume number area
	X	X	WORK	YES		Required for combined control of IN and OUT
X		X	XPDT ①	Symbolic label		For standard label checking, address of the expiration date area

① Not available on 8K sort.

Table B–1. Sort Statements With Common Parameters (Part 3 of 3)

Statement	Positional Parameter of Keyword	Specification	Required	Remarks
END			√	Required as last statement card
FIELD				Required to specify sort keys or record sequence code
	p	Position of most significant byte	√	To request setup stage to generate the 0 key comparison code; more than one statement may be used; at least first two positional parameters, p and n, are required
	n	Number of bytes in field	√	
	f	Format	√	
	s	Sequence		
	RSOC	Symbolic label		Address of user own code for determining record sequence
ILB ①				To substitute user values for IN label
	f	File identification		All parameters are optional
	c	Creation date		
	g	Generation number		
	v	Volume number		
OLB ①				To substitute user values for OUT label
	f	File identification		All parameters optional
	c	Creation date		
	g	Generation number		
	v	Volume number		
	x	Expiration date		
PART ①				To request PART sorting
		INPUT		Both positional parameter p
	SUB	n=number of 1st subfile		(=INPUT) and keyword SUB required
	p	OUTPUT		Positional parameter p
	SUB	n=number of 1st subfile		(=OUTPUT), SUB, and SUBS required plus either SUBG
	SUBS	n=smallest subfile number		or TERM=FINAL
	SUBG	n=greatest subfile number		
	TERM	FINAL		
RSTRT ①				To request restart
	p	Blank		Restart from unsolicited keyin
	p	SAME		Recreate subfile from first dump on tape
	p	NEW		Recreate subfile on new tape from first dump
	p	NEXT		Recreate subfile from second dump on previous tape

① Not available on 8K sort.

Table B–2. Sort Statements Without Common Parameters (Part 1 of 2)

Statement	Positional Parameter of Keyword	Specification	Required	Remarks
TAPES				
	p_1	Logical unit number	√	Specifies sort work tapes
	p_2	Logical unit number	√	At least three logical units required
	p_3	Logical unit number	√	
	.	.		
	.	.		
	.	.		
	p_n			
WLB ①				To substitute user values for work tape labels; all parameters optional
	f	File identification		
	c	Creation date		
	g	Generation number		
	v	Volume number		
	x	Expiration date		

① Not available on 8K sort.

Table B–2. Sort Statements Without Common Parameters (Part 2 of 2)

APPENDIX C. EXAMPLES OF OWN CODE AND CROSS REFERENCING

C.1. HEADER CARDS AND SENTINELS

Own-code modules are surrounded by fixed-format header cards and end sentinels to indicate to the setup stage the phase during which the module is to be loaded. Code that is to remain in memory at all times is preceded by the header PHASE COMMON and is followed by PHASE END. Each element within the phase is preceded by an INCLUDE card. For the tape system, the card may specify module name and logical unit number. (See Figures C–1, C–2.) Similarly, code to be resident in memory only during the input stage is preceded by a PHASE IN header card, that for the output stage by a PHASE OUT header card. Each set of modules is followed by a PHASE END sentinel card. If no own code is required for a phase, the PHASE END sentinel alone is used. (See also Appendix A, Figures A–1 and A–2.)

C.2. CROSS REFERENCING BETWEEN PHASES

A module included in PHASE IN may not reference an ENTRY defined in a module of PHASE OUT, and vice versa.

Any own-code module may reference system labels listed in Section 2.

C.3. CROSS REFERENCING BETWEEN ELEMENTS

The rules are:

- The label of the START line of an element is an ENTRY of the element (including a blank label).
- Any element within a phase may make a reference requiring a 2-byte address substitution of the value of an ENTRY in any other element of the phase.
- If, however, the reference requires a 2-byte address plus an addend, the element defining the ENTRY must be loaded before the element referencing it by way of EXTRN.

In Figure C–3, the line labeled A4 makes a valid reference to the start line of ELTB. The line labeled A3 makes two valid references to ENTRYs B2 and B3 of ELTB.

The line labeled A1, however, makes an invalid reference to the ENTRY B2 plus an addend of 10.

The line labeled B1 makes a valid reference to ENTRY A2 plus an addend because A2 will be loaded (evaluated) prior to line B1.

In Figures C–3 and C–4, each element (ELTA, ELTB, and LBL) beginning with the START card and ending with the END card must be assembled separately. The output of the assembler is inserted after the INCLUDE card.

```
LABEL          OPERATION          OPERAND
1              10                 16
               PHASE   COMMON
               INCLUDE
HERE INCLUDE   SOURCE CARDS OF FIRST COMMON ELT
               :
               INCLUDE
2ND ELT FOLLOWS ITS OWN INCLUDE CARD
               :
               PHASE   END
               :
               PHASE   IN
               INCLUDE
1ST ELT OF INPUT PHASE OWN CODE
               :
               INCLUDE
2ND ELT OF INPUT PHASE OWN CODE
               :
               PHASE   END
               PHASE   OUT
               INCLUDE
1ST ELT OF OUTPUT STAGE OWN CODE
               :
               :
               PHASE   END
```

Figure C–1. Card System: Header and Sentinel Cards

```
LABEL    OPERATION  OPERAND                                         COMMENTS
         PHASE      COMMON
         INCLUDE    name,l.u.
         INCLUDE    name,l.u.
         PHASE      END
         PHASE      IN
         INCLUDE    name,l.u.
         INCLUDE
 OWN CODE ELT MAY ALSO COME FROM CARDS
         :
         INCLUDE    name,l.u.
         PHASE      END
         PHASE      END      IF NO PHASE OUT, FOR EXAMPLE, USE PHASE END ALONE
```

NOTE:

The parameter l.u. is a one-character number, O-F, logical unit number 0 is normally the systems tape: its use here would mean that the sort's own code is included on the system tape. This procedure is not recommended unless a separate system tape is maintained for the sort, and its own code elements only.

Figure C–2. Tape System: Header and Sentinel Cards

```
LABEL    OPERATION  OPERAND                                         COMMENTS
         PHASE      COMMON
         INCLUDE
ELTA     START      0
         USING      *,0
         ENTRY      A1
         ENTRY      A2
         ENTRY      B2
         ENTRY      B3                                                         †
A1       LH         10,B2+10       INVALID REFERENCE TO LABEL PLUS ADDEND
         :
A2       DS         8C4
A3       MVC        B2(6),B3       VALID REFERENCES TO LABELS
A4       BC         15,ELTB        VALID REFERENCE TO ELT START LINE
         END
         INCLUDE
ELTB     START      0
         USING      *,0
         ENTRY      B2
         ENTRY      B3
         ENTRY      A2                                                         †
B1       LH         10,A2+10       VALID REFERENCE TO LABEL PLUS ADDEND
         :
B2       DS         8C4
B3       DS         8C4
         END
         PHASE      END
```

†Assembler output

Figure C–3. Cross References Between Own Code Elements

```
LABEL     OPERATION     OPERAND                                   COMMENTS
1         10            16                                        72
          IN            BKSZ=n1,RCSZ=n2,DEVA=n3,CRDT=ILC6
          OUT           BKSZ=n4,RCSZ=n5,DEVA=n6,CRDT=OLC6,XPDT=OLX6
          SORT          CRDT=WLC6,XPDT=WLX6
                        :
* THE ABOVE STMTS WOULD REQUIRE THE FOLLOWING OWN CODE
          PHASE         COMMON
          INCLUDE
LBL       START         0
          USING         *,0
          ENTRY         ILC6
          ENTRY         OLC6
          ENTRY         WLC6
          ENTRY         OLX6
          ENTRY         WLX6
ILC6      DC            CL6'aaaaaa'
OLC6      DC            CL6'bbbbbb'
WLC6      DC            CL6'cccccc'
OLX6      DC            CL6'dddddd'
WLX6      DC            CL6'eeeeee'
          END
          PHASE         END
                        :
* WHERE THE SYMBOLS aaaaaa THRU eeeeee ARE THE USER'S 6 CHARACTER DATES
```

† Assembler output

Figure C–4. Own Code for 6-Character Label Dates

APPENDIX D. PROGRAMMING EXAMPLES

D.1. EXAMPLE 1

Logical tape unit numbers 05, 06 and 07 are available for work tapes. The work tape label is standard, and the label information supplied by the sort program is satisfactory for the work tapes. The highest-numbered byte the sort program is to use is 16,383. The input file has the following characteristics:

- Label Format – standard
- File Identification – UNSORTED
- Creation Date – 66160
- Generation Number – 0001
- Block Size – 1200 bytes
- Logical Tape Unit Number – 04
- Record Format – fixed length
- Record Size – 60 bytes
- KEY – Bytes 1–10
- Key Format – alphanumeric

Checkpoint records on the input file are to be bypassed. The input file is to be rewound at open, read forward, and rewound with interlock at close. If there is an unrecoverable read, the job is to be canceled. Input records are to be sorted into ascending order.

The output file has the following characteristics:

- Label Format – standard
- File Identification – SORTEDXX
- Creation Date – 66160
- Generation Number – 0001
- Expiration Date – 66168

- Block Size – 1200 bytes
- Logical Tape Unit Number – 05
- Record Format – fixed length
- Record Size – 60 bytes

Checkpoint dumps can be made on output file volumes. The output file is to be rewound at open and rewound with interlock at close.

```
LABEL     OPERATION     OPERAND                    COMMENTS
1         10            16
*
* STATEMENT CARDS
*
          SORT    STOR=16383
          TAPES   05,06,07
          ILB     UNSORTED,66160,00001,00
          IN      BKSZ=1200,CKPT=YES,DEVA=04,RCSZ=60
          FIELD   1,10
          OLB     SORTEDXX,,,00,,66168
          OUT     BKSZ=1200,CKPT=YES,CRDT=ILBC,DEVA=05,GENO=ILBG,RCSZ=60
          END
```

Figure D–1. Sorting Program, Example 1

D.2. EXAMPLE 2

Example 2 is the same as example 1 except:

- The work tape file identification is to be SCRATCHX.
- An input procedure is to be used.
- Own code is to be used to sequence records.
- Data reduction own code is to be provided. If two records have equal keys, bytes 11–20 of the record to be deleted are to be decimally added to the corresponding bytes of the record to be retained.
- An output procedure is to be used.

NOTE:

In the second example, input procedure, record sequence own code, and output procedure are provided for illustrative purposes only. They do no more than the sort program described in Example 1.

```
LABEL   OPERATION   OPERAND                    COMMENTS
1       10          16                         72
*
* STATEMENT CARDS
*
        WLB         SCRATCHX
        SORT        STOR=16383,DROC=DROC
        TAPES       05,06,07
        ILB         UNSORTED,66160,0001,00
        IN          BKSZ=1200,CKPT=YES,DEVA=04,EOFA=IEOF,RCSZ=60,IPRO=IPRO,X
                    IORG=8
        FIELD       RSOC=RSOC
        OLB         SORTEDXX,,,00,66168
        OUT         BKSZ=1200,CRDT=ILBC,DEVA=05,EOFA=OEOF                    X
                    GENO=ILBG,RCSZ=60,OPRO=OPRO,IORG=9
        END
*
* THE FOLLOWING IS OWN CODE. IT SHOULD BE NOTED THAT, ALTHOUGH THIS
*       OWN CODE IS SHOWN HERE IN SOURCE CODE FORM, IT MUST FIRST BE
*       ASSEMBLED SO IT CAN BE INTRODUCED INTO THE SPOT IN RELOCATABLE
*       FORMAT.
*
* RECORD SEQUENCE OWN CODE
*
RSOC    START       0
        USING       *,0
        CLC         0(10,11),0(12)
        BC          15,0(,14)
        END
```

Figure D–2. Sorting Program, Example 2 (Part 1 of 3)

```
LABEL   OPERATION   OPERAND                    COMMENTS
1       10          16                         72
*
* DATA REDUCTION OWN CODE
DROC    START       0
        USING       *,0
        EXTRN       DELE
        AP          11(10,11),11(12)
        BC          15,DELE
        END
*
* INPUT PROCEDURE
*
IPRO    START       0
        USING       *,0
        ENTRY       IEOF
        EXTRN       SORT
        EXTRN       IN
        OPEN        IN
C1      GET         IN
        STH         8,*+8
        PUT         SORT
        BC          15,C1
IEOF    CLOSE       IN
        CLOSE       SORT
        END
```

Figure D–2. Sorting Program, Example 2 (Part 2 of 3)

```
LABEL     OPERATION     OPERAND          COMMENTS
1         10            16               72
*
*OUTPUT PROCEDURE
*
OPRO      START  0
          USING  *,0
          ENTRY  OEOF
          EXTRN  SORT
          EXTRN  OUT
          OPEN   OUT
C2        STH    9,*+8
          GET    SORT
          PUT    OUT
          BC     LS,C2
OEOF      CLOSE  OUT
          CLOSE  SORT
          END
```

Figure D–2. Sorting Program, Example 2 (Part 3 of 3)

APPENDIX E. SORT ERROR DISPLAYS

E.1. GENERAL

The sort program error displays are listed in Table E–1. The meaning of the abbreviations in the source column are:

SU_n, SV_n } Setup stage, load n

T Tape dispatcher

U Sort control section

V Sort overlaps

Sort Error Displays			
Message	Source	Reason	Action
0001	SU_2	Invalid character in parameter	Press START switch to display ccll. Press START switch to continue.
0002	SU_2	Invalid character cycled to first position	Press START switch to display ccll. Press START switch to cancel.
0003	SU_2	Source string greater than eight characters	Press START switch to display ccll. Press START switch to continue.
0004	SU_2	No END statement found	Press START switch to display ccll. Press START switch to cancel.
0005	SU_2	Label found on statement card, invalid statement, or in characters in columns 1–15 of continuation card	Press START switch to display ccll. Press START switch to continue.
0006	SU_2	Statement name or keyword not found in SORT's known list	Press START switch to display ccll. Press START switch to continue.
0007	SU_2	Actions not completed for a statement or parameter	Press START switch to display ccll. Press START switch to cancel.
0008	SU_2	Too many characters in value	Press START switch to display ccll. Press START switch to cancel.
0009	SU_2	Not enough memory for internal tables	Press START switch to display ccll. Press START switch to cancel.
000A	SU_2	Invalid character in statement name	Press START switch to display ccll. Press START switch to continue.
0101	SU_3	Fewer than three tape units specified	Press START switch to cancel.
0102	SU_3	No valid RCSZ in either IN or SORT	Press START switch to cancel.
0103	SU_3	Not enough memory for internal tables (FIELD, STOR parameters)	Press START switch to cancel.
0104	SU_3	Invalid FIELD statement; p=0, or FI is 1<2	Press START switch to cancel.
0105	SU_3	FIELD statement missing	Press START switch to cancel.
0115	SU_3	TAPES statement missing	Press START switch to cancel.
0125	SU_3	IN statement missing or improper	Press START switch to cancel.
0135	SU_3	OUT statement missing or improper	Press START switch to cancel
0145	SU_3	OUT statement RCSZ too small	Press START switch to cancel.
0149	SU_3	FIELD statement parameter address beyond SORT RCSZ	Press START switch to cancel.
0155	SU_3	SORT or OUT statement contains invalid FLBL option	Press START switch to cancel.
0165	SU_3	IN or OUT statement contains improper DEVA; 7-track and 9-track tapes mixed with multiple sort	Press START switch to cancel.

Table E–1. Sort Program Error Displays (Part 1 of 6)

Sort Error Displays			
Message	**Source**	**Reason**	**Action**
0175	SU_3	Missing or invalid parameter in PART INPUT	Press START switch to cancel.
0185	SU_3	Missing or invalid parameter in PART OUTPUT	Press START switch to cancel.
0195	SU_3	Invalid RCSZ; 7-track tapes, fixed, requires multiple of 6	Press START switch to cancel.
0196	SU_3	Improper physical unit; 7-track without conversion impossible for RCFM=VAR	Press START switch to cancel.
0197	SU_3	Improper combination of physical units; merge cannot use both 7- and 9-track	Press START switch to cancel.
0200	SV_7	SORT and own-code memory requirements too great	Reply 1 to display additional memory required. Press START switch to cancel. Reply 0 to cancel.
0201	SV_8	RCSZ BKSZ too large for minimum SORT	Press START switch to cancel.
0202	SV_7	IN or OUT BKSZ too small (<16)	Press START switch to cancel.
0203	SV_8	RCSZ too large for SORT with number of tape units requested	Reply 1 to reduce number of tape units by 1. Reply 0 to cancel.
0204	SV_8	BKSZ greater than 8191	Press START switch to cancel.
0205	SV_7	Not enough memory space for tape sort loader to read in overlays	Press START switch to cancel.
0301	SU_5,SV_A	Hole count check failure	Remove cards from input hopper; run out last card; refeed last three cards of input. NOTE: In the tape system, these cards must be preceded by a DATA C card.
0302	SU_5, $SV_{A,6}$	Sequence table exhausted Relocatable sort LIB or own code are out of sequence	Press START switch to cancel. Press START switch to cancel.
0303	SU_5, $SV_{A,6}$	Invalid card sequence	Press START switch to cancel.
0304	SU_5, $SV_{A,6}$	Too many ENTRYs and/or EXTRNs	Press START switch to cancel.
0305	SU_5, $SV_{A,6}$	Improper EXTRN, LOAD MOD KEY, or ENTRY (Appendix C)	Press START switch to cancel.
0306	SU_5, SV_A	Statements or own code improperly placed in sort deck (Tables A–1 and A–2)	Press START switch to cancel.

Table E–1. Sort Program Error Displays (Part 2 of 6)

Sort Error Displays			
Message	Source	Reason	Action
0307	SU_5, $SV_{A,7}$	EXTRN is not satisfied by matching ENTRY	Press START switch to cancel.
0308	SU_5, $SV_{A,7}$	Not enough memory for this SORT plus own code	Press START switch to cancel.
0309	SU_5, $SV_{A,7}$	Doubly defined ENTRY	Press START switch to cancel.
0310	SV_A	For RSTRT, present upper bound of memory greater than in checkpoint dump	Press START switch to cancel.
3FE 3FD 3FF 3FA			Refer to A.5, sort standard operating displays.
0400	SV_3	Insufficient memory space to complete sort loading	Press START switch to cancel.
0401	U	EXTRN remains undefined after loading sort overlay	Press START switch to cancel.
0402	U	Sort library with needed overlay not found on work tape	Press START switch to cancel.
0410	SV_2	For RSTRT, block just read should belong to first checkpoint dump, but does not	Reply 1 to try again with new tape mounted. Reply 0 to cancel.
0411 0413	V V	No input buffer available No output buffer available	Sort precautionary check has failed. Obtain memory dump. Cancel.
0421	V	Premature end of data	Press START switch to cancel.
0422	V	Premature end of string	Press START switch to cancel.
042D	V	End of tape encountered on work tape	Press START switch to cancel.
0430	V	Sequence error	Press START switch to cancel.
0432	V	Preselect error	Press START switch to cancel.
0500	SV_5	Not enough memory space for internal tables for own code check	Press START switch to cancel.
0501	SV_5	Double definition of ENTRY in own code	Press START switch to cancel.
0502	SV_5	Own code ENTRY defined or referenced in wrong PHASE	Press START switch to cancel.
0503	SV_5	Undefined EXTRN in own code phase	Press START switch to cancel.

Table E–1. Sort Program Error Displays (Part 3 of 6)

Sort Error Displays			
Message	Source	Reason	Action
60i 70j 80i 90j			Refer to A.5, sort standard operating displays.
20U1	V	Output tape with standard labels failed to pass expiration date check	If the tape is manually rewound with interlock, another tape mounted, and the START switch pressed, the check will be made on the new tape. If something other than binary 0 is entered into memory location 4 via the ALTER switch and the START switch is pressed, magnetic tape IOCS cancels the main program.
20U2	V	Unit addressed is either allocated for some purpose other than the main program or is marked down	When the START switch is pressed in response to this display, magnetic tape IOCS cancels the main program.
20U3	V	The system is unable to read label block	When the START switch is pressed in response to this display, magnetic tape IOCS cancels the main program.
20U4	V	To-be-expected label cannot be found on file described as having standard labels	When the START switch is pressed in response to this display, magnetic tape IOCS cancels the main program.
20U6	V	Wrong length record check has failed	When the START switch is pressed in response to this display, magnetic tape IOCS cancels the main program.
20U7	V	Attempt made to advance a record from unopened file, or to close such a file	When the START switch is pressed in response to this display, magnetic tape IOCS cancels the main program.
20U8	V	Input label check failed	If the tape is manually rewound, a new tape mounted, and the START switch pressed, magnetic tape IOCS will make the label check on the new tape. If something other than binary 0 is entered into memory location 4 via the ALTER switch and the START switch is pressed, magnetic tape IOCS accepts the current tape even though the label check failed.
20U9	V	A block count error has occurred	If the START switch is pressed, magnetic tape IOCS cancels the main program. If something other than binary 0 is entered into memory location 4 via the ALTER switch before the START switch is pressed, magnetic tape IOCS continues as if the error had not occurred.
20UA	V	A TRUNC macro instruction has been executed for an unblocked file	When the START switch is pressed in response to this display, magnetic tape IOCS cancels the main program.
20UB	V	A PUT macro instruction has been executed in connection with an input-only I/O routine	When the START switch is pressed in response to this display, magnetic tape IOCS cancels the main program.

Table E–1. Sort Program Error Displays (Part 4 of 6)

Message	Source	Reason	Action
20UC	V	A GET macro instruction has been executed in connection with an output-only I/O routine	When the START switch is pressed in response to this display, magnetic tape IOCS cancels the main program.
20UD	V	End of tape encountered on an output procedure action	If the START switch is pressed, magnetic tape sort IOCS cancels the sort program. If binary 0 is entered into memory location 4 via the ALTER switch before the START switch is pressed, magnetic tape sort IOCS continues processing as if end of tape was not encountered. NOTE: There is no tape swap mechanism in the sort program, therefore, ignoring end of tape can result in a tape run-off.
20UE	V	Unrecoverable write error	Pressing START switch cancels the sort program.
20UF	V	Block count error recovery unsuccessfully attempted on a sort work tape	If the START switch is pressed, magnetic tape sort IOCS will cancel the sort program. If other than a binary 0 is entered into memory location 4 via the ALTER switch before the START switch is pressed, magnetic tape sort IOCS will again attempt to recover from this error.
4007	$SU_{5'}$ SV_A	Unable to read or write sort library on work tape	Press START switch to cancel.
4009	SU_2	Improper sequence of PHASE END and INCLUDE cards within own code element	Press START switch to cancel; correct sequence of cards and resubmit.
400B	U	Unable to find sort library on SORT work tape	Press START switch to cancel.
400C	U	Data error from sort library tape	Press START switch to cancel.
400D	U	Record count error from sort library tape	Press START switch to cancel.
400E	U	Unable to read block of sort library tape	Press START switch to cancel.
41EF		End of sort	No action
4300	SU_1	Card count error in loading setup stage overlay	Press START switch to continue despite message.
60U1	T	Tape dispatcher tried five times, unsuccessfully, to recover from a read or write tape error	To cause the tape dispatcher to retry five more times, press the START switch. To cause the tape dispatcher to skip the request packet on which the error is occurring and go to the next request packet, key a 1 into memory location 4 before pressing the START switch.

Table E–1. Sort Program Error Displays (Part 5 of 6)

Sort Error Displays			
Message	Source	Reason	Action
60U2	T	Invalid command sense bit (bit 0 of sense byte 0) set; caused by attempt to perform a write, write tape mark or erase operation on a file-protected tape unit	In this case, the operation can be effected by inserting the write enable ring in the tape reel and pressing the START switch.
60U3	T	Noise bit (bit 0 of the sense byte 1) set while erase command was being executed	Enter nonzero at location 4 via ALTER switch; press START switch to continue (error ignored). If START switch is pressed without entering nonzero, stop display 60U0 will occur; recovery is the same as for previous message.
60U4	T	Equipment check bit (bit 3 of sense byte 0) set	This is a nonrecoverable error.
60U5	T	Noise bit (bit 0 of sense byte 1) and tape-fault bit (bit 6 of sense byte 4) set during write or write tape mark operation	This is a nonrecoverable error.
60U7	T	Intervention-required bit (bit 1 of sense byte 0) set. Caused by attempt to perform a tape operation on a nonready unit	In this case, recovery consists of marking the unit ready and pressing the START switch.
60UC	T	Condition code 01 returned during initiation of current tape operation; generally occurs because function presented to control unit is invalid	To retry initiation of the operation, press the START switch; if the error persists, the job should be canceled.
60UD	T	Unit check has occurred but all bits of sense byte 0 are reset; indicates a read backward, backspace block, or backspace file operation has been attempted on a tape unit with tape at load point	This is a nonrecoverable error.
60UE	T	When the supervisor is generated, the channel(s) for the tape control units is specified as parameters. When a request is made of the tape dispatcher, the request specifies a logical unit number. The tape dispatcher verifies that the physical unit table entry specified by the logical unit number contains a channel number corresponding to one of those specified when the supervisor was generated.	If this is not the case, 60UE is displayed. This is a nonrecoverable error.
60UF	T	A condition code of 11 has been returned when initiating the current tape operation.	This indicates a nonoperational general purpose channel (GPC). Ready the GPC and press the START switch.

Table E–1. Sort Program Error Displays (Part 6 of 6)

APPENDIX F. SORT TIMING

Timing information for tape sorting in the UNIVAC 9200 II, 9300, and 9300 II Systems is listed in Tables F–1 and F–2. The tables are organized by system configuration to facilitate referencing. All timing is in minutes.

Record Size (in bytes)	Blocking Factor	Volume (in thousands)																					
		1		2		5		10		15		20		30		50		75		100		150		200	
		Key Size (in bytes)																					
		10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30
20	1	1	0	2	0	5	0	9	0	15	0	22	0	32	0	58	0	92	0	131	0	208	0	277	0
	20	1	0	2	0	5	0	10	0	15	0	22	0	35	0	61	0	98	0	130	0	207	0	292	0
	50	1	0	2	0	5	0	11	0	16	0	23	0	37	0	66	0	105	0	139	0	221	0	311	0
	100	2	0	3	0	9	0	19	0	30	0	42	0	67	0	118	0	185	0	247	0	389	0	544	0
30	1	1	1	2	2	5	6	12	13	18	21	24	26	39	45	70	79	112	127	149	169	237	270	334	380
	20	1	1	2	2	5	6	11	13	18	21	26	30	42	47	74	84	117	133	156	177	248	282	350	396
	40	1	1	2	3	6	7	14	16	21	23	29	33	47	53	82	93	131	148	174	197	276	312	388	438
	60	2	2	3	3	9	9	18	19	28	30	40	43	64	68	112	120	178	190	237	254	374	400	523	561
50	1	1	1	2	3	7	7	14	15	22	25	32	36	52	57	92	102	146	162	195	217	310	344	438	486
	10	1	1	3	3	7	8	15	17	24	27	35	38	52	57	92	102	146	162	207	230	328	364	438	486
	25	2	2	3	3	8	9	17	19	28	31	40	44	63	69	111	122	176	194	235	259	372	409	523	575
	40	4	4	8	9	24	24	50	50	79	80	105	106	167	168	294	296	463	467	650	655	***	***	***	***
80	1	2	2	3	4	9	10	20	21	31	34	45	49	72	78	128	136	204	220	272	292	431	464	***	***
	5	2	2	4	4	9	10	21	23	34	36	45	48	72	77	127	136	203	218	286	307	429	461	***	***
	15	2	2	5	5	13	13	27	27	43	44	61	62	91	93	162	164	257	260	362	367	573	580	***	***
	25	6	6	13	13	37	37	83	84	125	126	176	177	279	281	490	494	***	***	***	***	***	***	***	***
100	1	2	2	4	4	11	11	26	26	41	42	55	56	84	89	156	159	249	253	352	357	***	***	***	***
	5	2	2	4	4	12	12	26	26	41	42	59	60	94	95	166	169	264	268	352	357	***	***	***	***
	10	2	2	5	5	14	14	30	31	48	49	69	70	103	104	183	185	291	294	410	414	***	***	***	***
	20	8	8	17	17	49	49	104	104	165	165	232	233	366	368	641	646	***	***	***	***	***	***	***	***
200	1	4	4	9	9	25	25	53	53	85	86	121	122	193	195	342	344	***	***	***	***	***	***	***	***
	5	5	5	10	10	29	29	67	67	100	101	142	143	227	228	400	402	***	***	***	***	***	***	***	***
	10	17	17	39	39	103	104	231	232	365	367	487	490	***	***	***	***	***	***	***	***	***	***	***	***
300	1	6	6	14	14	39	39	84	84	135	136	192	193	305	307	***	***	***	***	***	***	***	***	***	***
	3	7	7	16	16	45	45	95	96	153	153	216	218	324	326	***	***	***	***	***	***	***	***	***	***
	6	17	17	39	40	104	105	233	234	368	369	490	492	***	***	***	***	***	***	***	***	***	***	***	***
500	1	11	11	24	24	69	70	158	159	237	238	336	337	***	***	***	***	***	***	***	***	***	***	***	***
	2	13	14	29	29	82	83	186	187	279	280	394	396	***	***	***	***	***	***	***	***	***	***	***	***
	4	0	0	0	0	0	0	0	0	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
750	1	20	20	42	42	119	120	254	255	404	405	***	***	***	***	***	***	***	***	***	***	***	***	***	***
	2	31	31	70	70	186	187	417	419	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
1000	1	31	31	70	70	185	186	415	416	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
	2	0	0	0	0	0	0	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
2000	1	0	0	0	0	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***

UNIVAC 9200 II System
Memory Size: 12K Bytes

UNISERVO VI C Subsystem: 9 Track
1 Control Unit
3 Tape Units

Table F–1. UNIVAC 9200 II System Sort Program Timing (Part 1 of 16)

Record Size (in bytes)	Blocking Factor	Volume (in thousands) 1		2		5		10		15		20		30		50		75		100		150		200	
		Key Size (in bytes) 10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30
20	1	1	0	2	0	4	0	8	0	12	0	17	0	26	0	48	0	72	0	105	0	158	0	230	0
	20	1	0	2	0	4	0	8	0	13	0	17	0	29	0	48	0	79	0	105	0	157	0	229	0
	50	1	0	2	0	4	0	9	0	13	0	20	0	29	0	54	0	81	0	107	0	176	0	235	0
	100	2	0	3	0	8	0	18	0	27	0	40	0	60	0	109	0	163	0	237	0	356	0	•••	0
30	1	1	1	2	2	4	5	9	10	15	17	20	23	37	38	54	63	89	104	118	136	194	227	259	302
	20	1	1	2	2	5	5	10	11	15	17	22	25	37	37	59	69	88	103	118	137	193	224	258	299
	40	1	1	2	2	5	6	11	12	18	20	23	27	38	44	64	73	105	120	139	161	228	262	304	350
	60	2	2	3	3	8	8	16	16	26	27	35	36	57	59	95	98	157	161	209	214	341	350	•••	•••
50	1	1	1	2	2	5	6	12	13	18	20	26	30	39	44	72	82	108	122	158	179	236	268	315	358
	10	1	1	2	2	5	6	12	13	20	22	26	30	39	44	72	81	118	134	158	179	236	268	344	390
	25	1	2	3	3	7	8	15	17	22	25	33	36	50	54	91	100	136	149	198	217	298	326	•••	•••
	40	4	4	8	8	21	22	47	48	70	72	103	105	153	158	282	287	423	429	•••	•••	•••	•••	•••	•••
80	1	1	1	3	3	7	7	15	17	25	28	34	37	56	61	93	102	154	168	205	224	336	367	•••	•••
	5	2	2	3	3	8	9	15	17	25	28	34	37	56	61	93	102	154	168	204	224	336	367	•••	•••
	15	2	2	4	4	10	10	22	23	37	38	49	50	81	83	135	138	222	227	296	303	•••	•••	•••	•••
	25	6	6	12	12	37	38	74	75	122	124	163	165	268	271	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
100	1	2	2	4	4	9	10	20	21	30	31	40	42	66	69	113	115	187	191	249	254	•••	•••	•••	•••
	5	2	2	4	4	9	10	20	21	30	31	45	46	68	69	125	127	187	191	273	279	•••	•••	•••	•••
	10	2	2	4	4	11	11	24	25	41	42	54	55	90	92	150	153	246	251	328	335	•••	•••	•••	•••
	20	8	8	15	15	46	47	92	93	153	155	203	206	335	339	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
200	1	3	3	6	6	19	20	38	39	65	66	86	87	143	145	238	242	•••	•••	•••	•••	•••	•••	•••	•••
	5	4	4	8	9	23	24	52	53	87	88	116	117	173	175	318	322	•••	•••	•••	•••	•••	•••	•••	•••
	10	17	17	37	38	102	103	223	226	335	339	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
300	1	5	5	10	10	28	29	64	64	95	96	141	143	212	214	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	3	6	6	12	12	37	37	73	74	122	124	163	165	270	273	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	6	14	14	32	32	88	89	194	196	291	294	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
500	1	6	9	19	19	52	53	116	118	174	176	257	259	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	12	12	23	23	71	72	141	143	234	236	312	315	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	4	0	0	0	0	0	0	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
750	1	15	16	30	31	95	96	189	191	313	316	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	27	27	60	61	166	167	362	366	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
1000	1	26	26	57	57	155	157	340	343	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	0	0	0	0	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
2000	1	0	0	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••

UNIVAC 9200 II System
Memory Size: 12K Bytes

UNISERVO VI C Subsystem: 9 Track
1 Control Unit
4 Tape Units

Table F–1. UNIVAC 9200 II System Sort Program Timing (Part 2 of 16)

Record Size (in bytes)	Blocking Factor	Volume (in thousands)																					
		1		2		5		10		15		20		30		50		75		100		150		200	
		Key Size (in bytes)																					
		10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30
20	1	1	0	1	0	3	0	7	0	10	0	14	0	24	0	39	0	66	0	88	0	131	0	195	0
	20	1	0	2	0	3	0	7	0	10	0	16	0	23	0	44	0	65	0	87	0	146	0	194	0
	50	1	0	2	0	4	0	7	0	13	0	17	0	25	0	46	0	69	0	103	0	154	0	205	0
	100	2	0	4	0	8	0	19	0	28	0	43	0	64	0	119	0	179	0	238	0	•••	0	•••	0
30	1	1	1	2	2	4	4	8	9	12	13	18	21	26	31	50	58	74	86	99	115	166	193	221	257
	20	1	1	2	2	4	5	8	9	14	16	18	21	27	31	50	58	75	87	113	130	168	195	225	260
	40	1	1	2	2	5	5	10	11	15	17	19	22	33	37	54	62	92	105	122	140	183	209	271	311
	60	2	2	3	3	8	8	18	18	26	27	35	36	61	61	99	102	167	171	222	229	•••	•••	•••	•••
50	1	1	1	2	2	5	6	9	11	16	18	21	24	32	36	60	68	90	101	135	152	202	228	269	304
	10	1	1	2	2	5	6	11	12	16	18	21	24	37	41	61	68	103	116	136	154	205	231	304	342
	25	1	1	3	3	7	7	14	14	24	25	32	33	47	49	89	92	134	138	178	183	299	307	•••	•••
	40	4	4	8	8	22	22	50	51	75	77	100	102	170	173	284	288	•••	•••	•••	•••	•••	•••	•••	•••
80	1	1	2	2	3	6	7	15	15	22	23	33	34	50	51	83	85	141	145	187	193	•••	•••	•••	•••
	5	1	2	3	3	6	7	15	15	22	23	33	35	50	52	94	97	141	145	188	193	•••	•••	•••	•••
	15	2	2	4	4	10	11	24	24	35	36	47	48	79	81	132	135	198	202	297	304	•••	•••	•••	•••
	25	6	6	14	14	35	35	80	81	120	122	181	184	272	275	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
100	1	2	2	3	3	8	8	18	18	26	27	40	42	61	62	115	117	171	176	228	234	•••	•••	•••	•••
	5	2	2	3	4	9	10	18	19	31	32	42	43	62	64	118	121	176	180	235	241	•••	•••	•••	•••
	10	2	2	4	4	11	12	26	26	38	39	51	52	87	89	145	148	217	222	•••	•••	•••	•••	•••	•••
	20	8	8	18	18	50	51	100	101	170	172	226	230	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
200	1	3	3	6	6	16	17	38	39	57	58	76	77	130	132	216	220	•••	•••	•••	•••	•••	•••	•••	•••
	5	4	4	9	9	25	25	49	50	84	85	112	113	167	170	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	10	18	18	40	41	113	115	226	230	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
300	1	4	4	10	10	28	29	56	57	96	98	128	130	192	195	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	3	5	5	12	12	34	35	79	80	118	119	157	159	264	270	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	6	16	16	32	32	92	93	208	210	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
500	1	8	9	16	17	48	48	110	111	164	166	219	221	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	10	11	24	24	59	60	137	138	205	207	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	4	0	0	0	0	0	0	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
750	1	14	14	32	32	90	91	180	182	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	27	27	61	61	171	173	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
1000	1	24	24	48	48	137	138	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	0	0	0	0	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
2000	1	0	0	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••

UNIVAC 9200 II System
Memory Size: 12K Bytes

UNISERVO VI C Subsystem: 9 Track
1 Control Unit
5 Tape Units

Table F–1. UNIVAC 9200 II System Sort Program Timing (Part 3 of 16)

Record Size (in bytes)	Blocking Factor	Volume (in thousands)																					
		1		2		5		10		15		20		30		50		75		100		150		200	
		Key Size (in bytes)																					
		10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30
20	1	1	0	1	0	4	0	7	0	12	0	15	0	23	0	44	0	66	0	87	0	131	0	198	0
	20	1	0	1	0	4	0	7	0	12	0	15	0	23	0	44	0	65	0	87	0	149	0	199	0
	50	1	0	2	0	4	0	8	0	12	0	16	0	26	0	47	0	70	0	106	0	159	0	212	0
	100	2	0	4	0	11	0	21	0	31	0	49	0	73	0	121	0	209	0	279	0	•••	0	•••	0
30	1	1	1	2	2	4	5	9	10	13	15	17	20	25	30	49	58	74	87	98	115	168	198	224	264
	20	1	1	2	2	4	5	9	11	13	16	18	21	30	36	51	59	76	89	115	135	173	203	230	270
	40	1	1	2	2	5	6	10	11	14	17	22	26	33	39	55	64	95	110	127	147	190	220	254	293
	60	2	2	4	4	8	8	19	20	28	29	38	39	66	68	109	113	164	169	251	258	•••	•••	•••	•••
50	1	1	1	2	2	5	5	10	12	15	18	20	23	36	41	59	68	89	102	136	156	204	234	272	311
	10	1	1	2	2	5	5	11	12	16	18	25	26	37	42	61	69	105	120	139	159	209	239	•••	•••
	25	2	2	3	3	7	7	14	14	25	26	33	34	49	51	95	98	142	146	189	195	•••	•••	•••	•••
	40	4	5	8	9	25	25	58	59	88	89	116	118	202	205	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
80	1	1	1	3	3	7	8	14	15	21	22	33	34	49	51	81	84	141	147	188	195	•••	•••	•••	•••
	5	2	2	3	3	7	8	14	15	25	26	34	35	51	52	97	100	145	150	193	200	•••	•••	•••	•••
	15	2	2	4	4	10	11	24	25	36	37	48	50	84	87	140	144	210	216	•••	•••	•••	•••	•••	•••
	25	7	7	16	16	40	40	93	95	140	142	215	219	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
100	1	2	2	3	3	9	9	17	17	30	31	40	41	59	61	115	118	172	177	229	236	•••	•••	•••	•••
	5	2	2	3	3	9	9	18	18	32	32	42	43	63	64	122	125	182	187	•••	•••	•••	•••	•••	•••
	10	2	2	5	5	11	11	26	27	39	40	52	54	92	94	152	156	228	234	•••	•••	•••	•••	•••	•••
	20	8	9	20	20	58	59	116	118	202	205	269	273	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
200	1	3	3	7	7	16	16	37	38	56	57	74	76	131	134	218	222	•••	•••	•••	•••	•••	•••	•••	•••
	5	4	4	9	9	25	26	50	51	88	90	118	120	176	180	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	10	20	20	47	48	135	137	269	273	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
300	1	4	4	9	10	28	28	55	56	97	98	128	131	193	196	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	3	6	6	12	12	35	36	83	84	124	126	165	167	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	6	18	18	35	36	103	105	238	242	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
500	1	8	8	16	16	48	49	113	115	170	173	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	10	11	25	25	62	62	145	147	218	221	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	4	0	0	0	0	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
750	1	14	14	32	33	95	96	189	192	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	28	29	66	67	190	194	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
1000	1	25	25	49	50	145	147	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	0	0	0	0	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
2000	1	0	0	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••

UNIVAC 9200 II System
Memory Size: 12K Bytes

UNISERVO VI C Subsystem: 9 Track
1 Control Unit
6 Tape Units

Table F–1. UNIVAC 9200 II System Sort Program Timing (Part 4 of 16)

Record Size (in bytes)	Blocking Factor	Volume (in thousands)																					
		1		2		5		10		15		20		30		50		75		100		150		200	
		Key Size (in bytes)																					
		10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30
20	1	1	0	2	0	4	0	9	0	14	0	20	0	32	0	57	0	85	0	121	0	193	0	273	0
	20	1	0	2	0	4	0	9	0	14	0	20	0	32	0	57	0	90	0	120	0	192	0	271	0
	50	1	0	2	0	4	0	9	0	15	0	21	0	34	0	60	0	89	0	127	0	202	0	268	0
	100	1	0	2	0	5	0	11	0	16	0	23	0	37	0	66	0	105	0	139	0	221	0	311	0
30	1	1	1	2	2	5	6	10	12	17	19	22	25	36	40	63	72	101	115	143	164	215	246	304	347
	20	1	1	2	2	5	6	10	12	16	19	24	27	38	43	67	77	107	123	143	163	228	261	322	367
	40	1	1	2	2	5	6	11	13	18	20	24	27	39	44	68	77	108	124	153	175	243	277	324	369
	60	1	1	2	3	5	6	12	14	20	22	26	30	42	47	74	84	118	134	167	189	250	284	352	400
50	1	1	1	2	2	6	7	14	15	22	24	29	32	46	52	83	92	132	147	176	197	281	313	397	443
	10	1	1	2	3	6	7	13	15	22	24	31	35	46	52	82	92	132	147	187	209	298	332	396	443
	25	1	1	3	3	6	7	15	16	23	26	31	35	50	56	88	99	141	157	199	222	316	352	422	469
	40	1	2	3	3	8	9	17	18	27	29	35	39	57	63	100	111	160	176	225	249	356	393	475	524
80	1	2	2	3	3	8	9	18	20	27	30	39	43	63	69	112	122	179	195	238	260	380	414	536	585
	5	2	2	3	3	8	9	18	20	29	32	39	43	63	69	112	122	179	195	253	276	380	414	536	585
	15	2	2	3	3	9	9	20	22	32	35	42	46	68	74	120	131	191	208	255	277	404	439	***	***
	25	2	2	4	4	11	11	25	25	40	40	53	54	84	85	149	151	236	240	333	338	499	507	***	***
100	1	2	2	4	4	10	11	21	23	34	36	45	48	72	78	129	138	206	222	291	313	463	499	***	***
	5	2	2	4	4	10	11	21	23	34	36	48	52	77	83	137	148	219	236	291	313	463	499	***	***
	10	2	2	4	4	10	11	22	24	36	39	48	52	77	83	136	147	217	234	307	330	486	523	***	***
	20	2	2	5	5	14	14	30	31	48	49	69	70	103	104	183	185	291	294	410	414	***	***	***	***
200	1	3	3	7	7	20	20	42	42	68	68	97	98	152	157	276	279	439	443	***	***	***	***	***	***
	5	4	4	7	7	21	21	45	46	73	73	104	104	165	167	292	295	438	441	***	***	***	***	***	***
	10	5	5	10	10	29	29	67	67	100	101	142	143	227	228	400	402	***	***	***	***	***	***	***	***
300	1	5	5	11	11	31	31	67	67	107	108	153	154	245	247	434	436	***	***	***	***	***	***	***	***
	3	5	5	12	12	31	31	72	72	115	116	153	154	245	247	434	436	***	***	***	***	***	***	***	***
	6	7	7	15	15	43	44	92	93	147	148	209	210	313	315	***	***	***	***	***	***	***	***	***	***
500	1	9	9	19	19	55	55	126	127	189	190	269	271	429	431	***	***	***	***	***	***	***	***	***	***
	2	9	9	21	21	59	60	126	127	202	203	286	288	429	431	***	***	***	***	***	***	***	***	***	***
	4	13	14	29	29	82	83	186	187	279	280	394	396	***	***	***	***	***	***	***	***	***	***	***	***
750	1	14	14	30	31	88	88	201	202	302	303	428	429	***	***	***	***	***	***	***	***	***	***	***	***
	2	17	17	36	37	104	105	237	237	354	355	***	***	***	***	***	***	***	***	***	***	***	***	***	***
1000	1	20	20	44	44	125	126	285	286	427	428	***	***	***	***	***	***	***	***	***	***	***	***	***	***
	2	31	31	70	70	185	186	415	416	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
2000	1	0	0	0	0	0	0	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***

UNIVAC 9200 II System
Memory Size: 16K Bytes

UNISERVO VI C Subsystem: 9 Track
1 Control Unit
3 Tape Units

Table F–1. UNIVAC 9200 II System Sort Program Timing (Part 5 of 16)

Record Size (in bytes)	Blocking Factor	Volume (in thousands) 1		2		5		10		15		20		30		50		75		100		150		200	
		Key Size (in bytes) 10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30
20	1	1	0	2	0	4	0	7	0	12	0	15	0	24	0	43	0	71	0	94	0	155	0	207	0
	20	1	0	2	0	4	0	8	0	12	0	15	0	26	0	47	0	70	0	94	0	154	0	206	0
	50	1	0	2	0	4	0	8	0	11	0	17	0	25	0	47	0	70	0	102	0	153	0	224	0
	100	1	0	2	0	4	0	9	0	13	0	20	0	29	0	54	0	81	0	107	0	176	0	235	0
30	1	1	1	2	2	4	5	9	10	13	15	19	22	28	33	52	62	78	92	115	135	173	203	230	270
	20	1	1	2	2	4	5	9	10	14	17	19	22	28	33	51	60	85	100	113	133	170	199	248	291
	40	1	1	2	2	5	5	9	10	14	17	19	22	32	37	53	61	87	101	116	135	190	222	253	296
	60	1	1	2	2	5	5	10	12	15	17	22	25	33	38	60	70	90	104	132	153	197	229	263	305
50	1	1	1	2	2	5	5	10	11	17	19	22	26	37	43	62	71	103	117	137	157	225	257	300	343
	10	1	1	2	2	5	6	10	11	17	19	22	26	37	43	62	71	102	117	137	156	225	257	300	343
	25	1	1	2	2	5	6	12	13	17	19	26	29	35	43	70	80	105	119	154	175	231	262	336	381
	40	1	1	3	3	6	7	14	16	21	23	28	31	46	51	76	85	125	141	167	188	274	309	365	411
80	1	1	1	2	3	6	7	14	16	21	23	31	34	44	51	85	95	128	143	188	209	282	314	•••	•••
	5	1	1	2	3	6	7	14	16	21	23	31	34	45	51	85	95	128	142	188	209	282	314	•••	•••
	15	2	2	3	3	7	8	14	16	24	27	32	36	53	59	88	98	146	162	195	216	320	355	•••	•••
	25	2	2	3	4	9	9	20	20	33	34	44	45	66	68	122	124	182	186	267	272	•••	•••	•••	•••
100	1	1	2	3	3	7	8	16	17	26	29	35	39	52	58	97	107	145	160	214	235	•••	•••	•••	•••
	5	1	2	3	3	7	8	16	17	26	29	35	39	53	64	97	107	161	177	214	235	•••	•••	•••	•••
	10	2	2	3	3	8	9	18	20	27	29	36	39	60	65	100	108	165	178	220	238	•••	•••	•••	•••
	20	2	2	4	4	11	11	24	25	41	42	54	55	90	92	150	153	246	251	328	335	•••	•••	•••	•••
200	1	2	3	5	5	14	15	32	33	48	49	72	73	104	110	200	203	•••	•••	•••	•••	•••	•••	•••	•••
	5	3	3	5	6	15	15	34	35	57	58	76	77	126	128	210	213	•••	•••	•••	•••	•••	•••	•••	•••
	10	4	4	8	9	23	24	52	53	87	88	116	117	173	175	318	322	•••	•••	•••	•••	•••	•••	•••	•••
300	1	4	4	7	8	24	24	47	48	79	80	106	107	176	178	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	3	4	4	9	9	24	25	55	55	82	83	121	123	181	183	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	6	6	6	11	11	35	36	70	71	118	119	157	158	256	262	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
500	1	6	6	14	14	39	39	87	88	145	147	193	196	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	7	8	14	15	46	46	91	92	153	154	203	205	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	4	12	12	23	23	71	72	141	143	234	236	312	315	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
750	1	10	10	23	23	65	66	144	146	216	218	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	14	14	28	28	87	87	173	174	286	289	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
1000	1	16	17	32	33	101	102	202	203	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	26	26	57	57	155	157	340	343	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
2000	1	51	51	113	113	310	313	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••

UNIVAC 9200 II System
Memory Size: 16K Bytes

UNISERVO VI C Subsystem: 9 Track
1 Control Unit
4 Tape Units

Table F–1. UNIVAC 9200 II System Sort Program Timing (Part 6 of 16)

Record Size (in bytes)	Blocking Factor	Volume (in thousands)																					
		1		2		5		10		15		20		30		50		75		100		150		200	
		Key Size (in bytes)																					
		10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30
20	1	1	0	1	0	3	0	6	0	10	0	14	0	23	0	38	0	57	0	86	0	129	0	172	0
	20	1	0	1	0	3	0	7	0	10	0	14	0	23	0	38	0	57	0	85	0	128	0	170	0
	50	1	0	1	0	3	0	7	0	10	0	13	0	23	0	38	0	64	0	85	0	128	0	190	0
	100	1	0	2	0	4	0	7	0	13	0	17	0	25	0	46	0	69	0	103	0	154	0	205	0
30	1	1	1	2	2	4	4	8	9	11	13	15	18	24	30	42	50	72	84	96	112	143	168	213	250
	20	1	1	2	2	3	4	8	9	11	13	17	20	25	29	41	49	70	82	94	110	140	164	210	245
	40	1	1	2	2	4	5	8	9	13	15	17	20	24	30	49	57	73	85	97	113	163	190	217	253
	60	1	1	2	2	4	5	9	11	14	16	18	21	31	35	51	59	76	88	114	131	170	197	227	262
50	1	1	1	2	2	4	5	9	10	13	15	20	23	33	34	57	65	85	97	113	130	191	218	255	290
	10	1	1	2	2	5	5	9	10	15	17	20	23	33	34	57	65	85	97	113	129	190	218	254	290
	25	1	1	2	2	5	5	11	12	16	18	21	24	36	40	59	67	88	100	133	150	198	225	265	300
	40	1	1	3	3	6	6	12	13	18	20	28	30	42	45	78	83	117	125	156	166	262	279	•••	•••
80	1	1	1	2	2	6	6	11	12	19	21	25	28	43	47	71	79	106	118	159	177	239	265	•••	•••
	5	1	1	2	2	6	6	13	14	19	21	25	28	43	47	71	79	106	118	159	177	238	265	•••	•••
	15	1	1	2	2	6	7	14	15	21	22	32	35	47	50	79	83	133	141	178	187	•••	•••	•••	•••
	25	2	2	3	4	9	10	18	19	31	32	42	43	62	64	118	121	177	181	265	271	•••	•••	•••	•••
100	1	1	2	2	3	7	7	15	16	22	23	29	31	51	53	84	88	143	150	190	200	•••	•••	•••	•••
	5	1	2	2	3	7	7	15	16	22	23	29	31	51	53	84	88	142	150	190	200	•••	•••	•••	•••
	10	2	2	3	3	7	7	16	17	24	25	37	38	55	56	103	106	155	159	206	212	•••	•••	•••	•••
	20	2	2	4	4	11	12	26	26	38	39	51	52	87	89	145	148	217	222	•••	•••	•••	•••	•••	•••
200	1	2	2	5	5	14	14	27	28	47	48	63	64	94	96	179	181	•••	•••	•••	•••	•••	•••	•••	•••
	5	2	2	5	5	15	15	34	35	51	52	68	70	117	119	195	198	•••	•••	•••	•••	•••	•••	•••	•••
	10	4	4	9	9	25	25	49	50	84	85	112	113	167	170	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
300	1	4	4	7	7	20	20	46	47	69	70	92	93	157	159	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	3	4	4	7	7	21	21	49	50	73	74	112	114	168	170	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	6	5	5	11	12	33	33	75	76	112	114	150	151	254	257	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
500	1	6	6	13	13	38	38	75	76	129	131	172	174	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	6	6	14	14	41	42	95	96	141	143	189	191	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	4	10	11	24	24	59	60	137	138	205	207	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
750	1	10	10	20	20	58	58	133	134	199	201	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	12	13	29	29	82	83	163	165	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
1000	1	14	14	33	33	94	94	187	188	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	24	24	48	48	137	138	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
2000	1	48	48	110	111	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••

UNIVAC 9200 II System
Memory Size: 16K Bytes

UNISERVO VI C Subsystem: 9 Track
1 Control Unit
5 Tape Units

Table F—1. UNIVAC 9200 II System Sort Program Timing (Part 7 of 16)

Record Size (in bytes)	Blocking Factor	Volume (in thousands)																					
		1		2		5		10		15		20		30		50		75		100		150		200	
		Key Size (in bytes)																					
		10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30
20	1	1	0	2	0	3	0	7	0	10	0	15	0	22	0	37	0	64	0	85	0	128	0	170	0
	20	1	0	1	0	4	0	7	0	10	0	15	0	22	0	37	0	64	0	85	0	127	0	169	0
	50	1	0	1	0	4	0	7	0	11	0	15	0	22	0	43	0	64	0	85	0	128	0	194	0
	100	1	0	2	0	4	0	8	0	12	0	16	0	23	0	47	0	70	0	106	0	159	0	212	0
30	1	1	1	2	2	4	5	7	9	13	15	17	20	25	29	41	49	71	84	94	112	141	168	215	256
	20	1	1	2	2	4	4	7	8	12	15	16	19	24	29	47	55	70	83	93	110	160	189	212	252
	40	1	1	2	2	4	5	9	10	13	15	17	20	25	30	49	57	73	86	97	114	166	196	221	261
	60	1	1	2	2	4	5	9	11	13	16	18	21	31	36	51	60	76	89	117	137	175	205	233	273
50	1	1	1	2	2	4	5	10	11	15	17	19	22	29	33	56	65	83	97	111	129	191	221	255	295
	10	1	1	2	2	4	5	10	11	15	17	19	22	34	39	56	65	83	97	111	129	191	221	255	295
	25	1	1	2	2	5	5	10	12	15	17	20	23	35	41	59	67	88	101	135	155	202	232	269	309
	40	1	2	2	3	6	7	12	13	22	23	29	31	43	46	82	88	123	131	164	175	245	262	•••	•••
80	1	1	1	2	3	5	6	12	14	18	20	24	27	41	47	69	78	103	116	158	179	238	268	•••	•••
	5	1	1	2	3	5	6	12	13	18	20	24	26	41	47	69	77	119	134	158	179	237	268	•••	•••
	15	1	1	3	3	7	7	14	14	24	25	32	34	47	50	78	83	136	144	182	192	•••	•••	•••	•••
	25	2	2	3	3	9	10	22	22	32	33	43	44	64	66	124	127	186	191	•••	•••	•••	•••	•••	•••
100	1	1	1	3	3	6	6	14	15	21	22	33	35	49	52	81	87	141	151	187	201	•••	•••	•••	•••
	5	1	1	3	3	7	8	14	15	21	22	33	35	49	52	81	87	141	151	188	201	•••	•••	•••	•••
	10	2	2	3	3	8	8	16	16	27	28	36	38	54	56	105	108	158	162	210	216	•••	•••	•••	•••
	20	2	2	5	5	11	11	26	27	39	40	52	54	92	94	152	156	228	234	•••	•••	•••	•••	•••	•••
200	1	2	3	4	5	13	13	30	31	45	46	60	62	90	92	176	180	•••	•••	•••	•••	•••	•••	•••	•••
	5	3	3	6	6	14	15	34	35	51	52	68	69	119	122	199	203	•••	•••	•••	•••	•••	•••	•••	•••
	10	4	4	9	9	25	26	50	51	88	90	118	120	176	180	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
300	1	3	3	8	8	18	19	44	45	66	67	88	89	154	157	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	3	4	4	8	9	24	25	48	49	73	74	114	116	171	174	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	6	6	6	11	11	33	34	66	67	117	119	156	159	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
500	1	6	6	12	12	36	37	72	74	128	130	170	173	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	7	7	14	14	41	42	96	98	144	146	192	195	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	4	10	11	25	25	62	62	145	147	218	221	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
750	1	10	10	23	23	57	58	134	136	201	204	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	12	12	29	29	72	73	169	172	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
1000	1	14	14	33	33	95	97	190	193	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	25	25	49	50	145	147	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
2000	1	49	50	116	118	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••

UNIVAC 9200 II System
Memory Size: 16K Bytes

UNISERVO VI C Subsystem: 9 Track
1 Control Unit
6 Tape Units

Table F–1. UNIVAC 9200 II System Sort Program Timing (Part 8 of 16)

Record Size (in bytes)	Blocking Factor	Volume (in thousands)																					
		1		2		5		10		15		20		30		50		75		100		150		200	
		Key Size (in bytes)																					
		10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30
20	1	1	0	1	0	3	0	8	0	13	0	17	0	27	0	48	0	78	0	103	0	166	0	236	0
	20	1	0	1	0	4	0	8	0	12	0	16	0	27	0	48	0	77	0	110	0	165	0	235	0
	50	1	0	1	0	4	0	8	0	12	0	16	0	27	0	48	0	77	0	110	0	176	0	235	0
	100	1	0	2	0	4	0	8	0	12	0	18	0	28	0	51	0	82	0	109	0	174	0	247	0
30	1	1	1	2	2	4	5	8	10	14	16	20	23	29	34	57	66	86	99	123	142	197	227	262	303
	20	1	1	2	2	4	5	8	10	13	16	19	22	32	36	56	65	91	105	121	139	194	224	275	317
	40	1	1	2	2	4	5	9	11	15	17	19	22	32	36	56	65	91	105	121	139	194	224	275	317
	60	1	1	2	2	4	5	9	11	15	17	19	22	31	36	56	65	91	105	129	149	207	238	275	317
50	1	1	1	2	2	5	6	11	12	17	20	23	26	38	43	68	76	109	123	156	176	250	281	332	375
	10	1	1	2	2	5	6	11	12	17	20	25	28	38	42	67	76	109	123	156	176	249	280	332	375
	25	1	1	2	2	5	6	11	12	17	20	25	28	41	46	73	82	117	132	156	176	249	280	353	398
	40	1	1	2	2	5	6	12	13	19	21	25	28	40	45	72	81	116	130	165	185	247	277	350	394
80	1	1	1	2	3	6	7	14	16	23	26	31	34	50	55	90	99	145	160	207	228	311	341	441	485
	5	1	1	2	3	7	7	14	16	23	26	31	34	50	55	90	99	145	160	207	228	331	363	441	485
	15	1	1	2	3	7	7	14	16	23	26	34	37	54	60	97	107	145	160	207	228	331	363	441	485
	25	1	1	2	3	7	7	16	17	23	26	34	37	54	60	97	107	156	171	207	228	331	363	468	515
100	1	1	2	3	3	8	8	16	18	26	29	38	42	62	67	110	120	165	180	236	256	377	410	***	***
	5	1	2	3	3	8	8	16	18	26	29	38	42	62	67	110	120	177	193	236	256	377	410	***	***
	10	1	2	3	3	8	8	18	19	26	29	38	42	62	67	110	120	177	193	236	256	377	410	***	***
	20	2	2	3	3	8	9	18	19	29	31	38	42	64	67	110	120	177	193	252	273	400	435	***	***
200	1	2	2	4	5	13	14	31	32	46	48	66	69	107	111	191	199	305	318	***	***	***	***	***	***
	5	2	2	5	5	13	14	31	32	50	52	66	69	107	111	191	199	305	318	***	***	***	***	***	***
	10	2	3	5	5	14	15	31	32	50	52	71	74	115	119	204	212	325	338	***	***	***	***	***	***
300	1	3	3	7	7	21	21	45	45	73	73	105	106	168	170	300	303	***	***	***	***	***	***	***	***
	3	3	3	7	7	21	21	48	49	78	79	104	105	166	170	299	302	***	***	***	***	***	***	***	***
	6	3	3	8	8	23	23	48	49	78	79	112	113	166	170	299	302	***	***	***	***	***	***	***	***
500	1	6	6	12	12	37	37	86	86	128	129	184	185	295	297	***	***	***	***	***	***	***	***	***	***
	2	6	6	12	12	37	37	86	86	138	139	184	185	295	297	***	***	***	***	***	***	***	***	***	***
	4	6	6	14	14	40	40	86	86	138	139	197	198	315	317	***	***	***	***	***	***	***	***	***	***
750	1	9	9	20	20	59	59	137	138	205	206	293	295	***	***	***	***	***	***	***	***	***	***	***	***
	2	9	9	22	22	59	59	137	138	220	221	293	295	***	***	***	***	***	***	***	***	***	***	***	***
1000	1	13	13	29	29	85	85	182	182	292	294	***	***	***	***	***	***	***	***	***	***	***	***	***	***
	2	13	13	32	32	85	85	195	195	312	313	***	***	***	***	***	***	***	***	***	***	***	***	***	***
2000	1	31	31	67	67	194	194	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***

UNIVAC 9200 II System
Memory Size: 24K Bytes

UNISERVO VI C Subsystem: 9 Track
1 Control Unit
3 Tape Units

Table F–1. UNIVAC 9200 II System Sort Program Timing (Part 9 of 16)

Record Size (in bytes)	Blocking Factor	Volume (in thousands)																					
		1		2		5		10		15		20		30		50		75		100		150		200	
		Key Size (in bytes)																					
		10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30
20	1	1	0	1	0	3	0	6	0	10	0	13	0	23	0	37	0	62	0	83	0	138	0	183	0
	20	1	0	1	0	3	0	7	0	10	0	13	0	22	0	37	0	62	0	82	0	137	0	182	0
	50	1	0	1	0	3	0	7	0	10	0	15	0	22	0	41	0	62	0	82	0	137	0	182	0
	100	1	0	1	0	3	0	7	0	10	0	15	0	22	0	42	0	62	0	92	0	137	0	201	0
30	1	1	1	1	2	3	4	7	9	11	13	16	19	24	29	45	54	68	81	100	119	150	179	200	238
	20	1	1	1	2	3	4	7	9	11	13	16	19	24	29	45	54	68	80	100	119	150	178	220	261
	40	1	1	1	2	3	4	7	9	12	14	16	19	24	28	44	53	66	79	99	117	148	175	217	257
	60	1	1	1	2	3	4	7	9	12	14	16	19	27	32	44	53	74	88	99	117	148	175	217	257
50	1	1	1	2	2	4	4	8	10	14	16	19	22	31	36	52	60	87	101	116	134	192	222	256	296
	10	1	1	2	2	4	5	8	10	14	16	19	21	31	36	52	60	87	101	116	134	192	222	255	295
	25	1	1	2	2	4	5	10	11	14	16	19	21	31	36	52	60	87	101	116	134	192	222	255	295
	40	1	1	2	2	4	5	10	11	14	16	21	24	31	36	58	67	87	101	128	148	192	222	256	296
80	1	1	1	2	2	5	6	11	13	17	19	26	29	38	43	71	80	106	120	157	177	235	266	313	354
	5	1	1	2	2	5	6	11	13	17	19	25	28	38	42	70	79	105	118	155	175	233	262	310	350
	15	1	1	2	2	5	6	11	13	17	19	25	28	34	42	70	79	105	118	155	175	233	262	341	384
	25	1	1	2	2	5	6	11	13	19	22	25	29	42	48	70	79	117	132	156	176	257	290	343	386
100	1	1	1	2	2	6	6	13	14	19	21	28	31	42	47	79	88	118	131	175	195	262	291	•••	•••
	5	1	1	2	2	6	6	13	14	21	24	28	31	42	47	79	88	131	146	175	194	262	291	•••	•••
	10	1	1	2	2	6	6	13	14	21	24	28	31	47	53	79	88	131	146	175	194	288	321	•••	•••
	20	1	1	2	2	7	7	13	14	21	24	28	32	48	53	79	88	132	146	175	195	290	322	•••	•••
200	1	2	2	4	4	10	10	22	23	32	35	49	52	73	78	136	145	204	217	•••	•••	•••	•••	•••	•••
	5	2	2	4	4	10	10	22	23	32	35	49	52	73	78	136	145	204	217	•••	•••	•••	•••	•••	•••
	10	2	2	4	4	10	10	22	23	37	39	49	52	83	88	137	146	228	241	•••	•••	•••	•••	•••	•••
300	1	3	3	5	5	14	14	31	32	53	54	71	72	119	121	198	201	•••	•••	•••	•••	•••	•••	•••	•••
	3	3	3	5	5	16	16	31	32	53	54	71	72	119	121	198	201	•••	•••	•••	•••	•••	•••	•••	•••
	6	3	3	6	6	16	16	36	36	53	54	79	80	119	120	219	222	•••	•••	•••	•••	•••	•••	•••	•••
500	1	4	4	9	9	25	26	58	58	86	87	129	130	194	195	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	4	4	9	9	25	26	58	58	97	98	129	130	194	195	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	4	5	5	9	9	29	30	58	59	98	99	130	132	217	219	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
750	1	7	7	15	15	43	43	96	96	143	144	191	192	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	7	7	15	15	43	43	96	96	143	144	213	214	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
1000	1	9	9	20	20	57	57	127	128	190	191	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	9	9	20	20	57	58	129	129	214	216	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
2000	1	20	20	45	46	128	128	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••

UNIVAC 9200 II System
Memory Size: 24K Bytes

UNISERVO VI C Subsystem: 9 Track
1 Control Unit
4 Tape Units

Table F–1. UNIVAC 9200 II System Sort Program Timing (Part 10 of 16)

Record Size (in bytes)	Blocking Factor	Volume (in thousands)																					
		1		2		5		10		15		20		30		50		75		100		150		200	
		Key Size (in bytes)																					
		10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30
20	1	1	0	1	0	3	0	6	0	9	0	12	0	20	0	33	0	56	0	75	0	111	0	167	0
	20	1	0	1	0	3	0	6	0	9	0	12	0	20	0	33	0	56	0	74	0	111	0	166	0
	50	1	0	1	0	3	0	6	0	9	0	13	0	20	0	33	0	56	0	74	0	111	0	166	0
	100	1	0	1	0	3	0	6	0	9	0	13	0	20	0	37	0	56	0	74	0	125	0	166	0
30	1	1	1	1	2	3	3	6	8	9	11	15	17	22	26	36	42	61	72	81	96	137	162	182	216
	20	1	1	1	2	3	3	6	8	9	11	14	17	21	25	41	48	61	72	81	96	136	161	181	215
	40	1	1	1	2	3	4	6	7	11	13	14	17	21	25	40	47	59	70	79	94	134	158	178	211
	60	1	1	1	2	3	4	6	7	11	13	14	17	21	25	40	47	60	71	79	94	134	159	179	212
50	1	1	1	2	2	4	4	7	8	12	14	16	19	24	28	46	54	70	80	92	107	158	182	210	242
	10	1	1	2	2	4	4	7	8	12	14	16	19	24	28	46	54	69	80	105	121	157	182	209	242
	25	1	1	2	2	4	4	8	10	12	14	16	19	28	32	46	54	69	80	105	121	157	182	209	242
	40	1	1	2	2	4	4	8	10	12	14	16	19	23	33	47	54	79	92	106	122	158	183	211	244
80	1	1	1	2	2	4	5	10	11	15	17	20	22	34	38	56	64	96	109	128	145	192	217	288	325
	5	1	1	2	2	4	5	10	11	15	17	20	22	34	38	56	64	96	109	128	145	192	217	288	325
	15	1	1	2	2	4	5	10	11	15	16	23	25	34	38	56	63	95	107	127	143	190	214	285	320
	25	1	1	2	2	4	5	10	11	15	17	23	26	34	38	64	72	96	108	128	144	217	243	289	324
100	1	1	1	2	2	5	5	11	12	16	18	25	28	38	42	62	69	107	119	142	159	213	237	***	***
	5	1	1	2	2	5	5	11	12	16	18	25	28	38	42	62	69	107	119	142	158	241	268	***	***
	10	1	1	2	2	5	5	11	12	16	18	25	28	38	42	71	79	107	119	142	158	241	268	***	***
	20	1	1	2	2	6	6	11	12	19	21	26	28	38	42	72	80	108	120	144	160	244	271	***	***
200	1	2	2	3	3	9	9	20	21	30	31	40	41	69	71	114	118	171	176	***	***	***	***	***	***
	5	2	2	3	3	9	9	20	21	30	31	40	41	69	71	114	118	194	200	***	***	***	***	***	***
	10	2	2	3	3	9	9	21	21	31	32	41	42	71	73	118	121	202	206	***	***	***	***	***	***
300	1	2	2	4	4	12	13	29	29	43	44	67	68	100	101	166	168	***	***	***	***	***	***	***	***
	3	2	2	5	5	12	13	29	29	43	44	67	68	100	101	189	192	***	***	***	***	***	***	***	***
	6	2	2	5	5	15	15	29	30	51	52	68	69	102	103	193	196	***	***	***	***	***	***	***	***
500	1	4	4	8	8	23	24	46	47	81	82	107	109	161	163	***	***	***	***	***	***	***	***	***	***
	2	4	4	8	8	23	24	46	47	81	82	107	109	184	186	***	***	***	***	***	***	***	***	***	***
	4	4	4	8	8	24	25	56	57	84	85	112	113	192	194	***	***	***	***	***	***	***	***	***	***
750	1	6	6	12	12	34	34	80	80	119	120	159	160	***	***	***	***	***	***	***	***	***	***	***	***
	2	6	6	12	12	34	35	80	81	120	121	183	185	***	***	***	***	***	***	***	***	***	***	***	***
1000	1	8	8	18	19	53	53	105	106	181	182	***	***	***	***	***	***	***	***	***	***	***	***	***	***
	2	8	8	19	19	55	55	110	110	189	190	***	***	***	***	***	***	***	***	***	***	***	***	***	***
2000	1	19	19	44	44	108	109	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***

UNIVAC 9200 II System
Memory Size: 24K Bytes

UNISERVO VI C Subsystem: 9 Track
1 Control Unit
5 Tape Units

Table F–1. UNIVAC 9200 II System Sort Program Timing (Part 11 of 16)

Record Size (in bytes)	Blocking Factor	Volume (in thousands)																					
		1		2		5		10		15		20		30		50		75		100		150		200	
		Key Size (in bytes)																					
		10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30
20	1	1	0	1	0	3	0	5	0	10	0	13	0	19	0	36	0	54	0	72	0	108	0	165	0
	20	1	0	1	0	3	0	5	0	9	0	12	0	18	0	36	0	54	0	71	0	123	0	164	0
	50	1	0	1	0	3	0	6	0	9	0	12	0	18	0	36	0	54	0	71	0	123	0	164	0
	100	1	0	1	0	3	0	7	0	10	0	13	0	19	0	36	0	54	0	72	0	124	0	165	0
30	1	1	1	1	1	3	4	7	8	10	12	13	16	20	24	39	47	58	70	77	93	134	161	178	215
	20	1	1	1	1	3	4	7	8	10	12	13	16	23	28	39	47	58	70	77	93	133	161	178	214
	40	1	1	1	1	3	4	7	8	10	12	13	16	23	28	39	47	58	70	89	107	133	161	178	214
	60	1	1	2	2	3	4	7	8	10	12	13	16	23	28	38	46	57	69	88	106	132	159	176	211
50	1	1	1	2	2	3	4	8	9	11	13	15	18	27	31	44	52	66	77	102	120	153	180	204	239
	10	1	1	2	2	3	4	8	9	11	13	15	18	27	31	44	52	76	90	102	120	152	179	203	239
	25	1	1	2	2	4	5	8	9	11	13	18	21	27	31	44	52	77	90	102	120	153	179	204	239
	40	1	1	2	2	4	5	8	9	11	13	18	21	27	31	44	52	77	91	103	121	154	181	206	241
80	1	1	1	2	2	5	5	9	10	16	18	21	24	32	36	53	60	92	106	123	141	184	211	282	323
	5	1	1	2	2	5	5	9	10	16	18	21	24	32	36	53	60	92	106	123	141	184	211	282	323
	15	1	1	2	2	5	5	9	10	16	18	21	24	31	36	61	70	91	104	121	139	182	208	279	319
	25	1	1	2	2	5	5	9	10	16	18	21	24	32	36	62	71	93	106	124	141	213	243	•••	•••
100	1	1	1	2	2	5	6	10	11	18	20	23	26	35	39	68	77	102	115	136	153	203	229	•••	•••
	5	1	1	2	2	5	6	10	11	18	20	23	26	35	39	68	77	102	115	136	153	234	264	•••	•••
	10	1	1	2	2	5	6	10	11	18	20	23	26	35	39	68	77	102	115	136	153	234	264	•••	•••
	20	1	1	2	2	5	6	12	14	18	20	24	27	35	40	69	78	104	117	138	156	239	269	•••	•••
200	1	2	2	3	4	8	8	18	19	27	28	36	38	64	67	106	111	159	167	•••	•••	•••	•••	•••	•••
	5	2	2	3	4	8	8	18	19	27	28	43	45	64	67	106	111	185	193	•••	•••	•••	•••	•••	•••
	10	2	2	4	4	10	10	19	20	28	29	45	46	67	69	112	115	195	200	•••	•••	•••	•••	•••	•••
300	1	2	2	5	5	13	14	26	27	46	47	62	63	92	94	154	157	•••	•••	•••	•••	•••	•••	•••	•••
	3	2	2	5	5	13	14	26	27	46	47	62	63	92	94	179	183	•••	•••	•••	•••	•••	•••	•••	•••
	6	3	3	5	5	14	14	27	27	48	49	64	65	96	98	186	190	•••	•••	•••	•••	•••	•••	•••	•••
500	1	4	4	7	7	21	21	50	51	75	76	99	101	149	151	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	4	4	7	7	21	21	50	51	75	76	99	101	175	177	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	4	4	4	9	9	22	22	53	54	79	80	105	107	185	188	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
750	1	5	5	13	13	31	31	74	74	110	111	147	148	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	5	5	13	13	38	38	75	76	113	114	176	178	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
1000	1	7	7	16	17	49	49	97	98	171	173	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	9	9	17	18	52	52	103	104	182	184	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
2000	1	17	17	41	42	102	103	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••

UNIVAC 9200 II System
Memory Size: 24K Bytes

UNISERVO VI C Subsystem: 9 Track
1 Control Unit
6 Tape Units

Table F–1. UNIVAC 9200 II System Sort Program Timing (Part 12 of 16)

Record Size (in bytes)	Blocking Factor	Volume (in thousands) 1		2		5		10		15		20		30		50		75		100		150		200	
		Key Size (in bytes) 10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30
20	1	1	0	1	0	3	0	7	0	12	0	15	0	25	0	45	0	72	0	96	0	155	0	222	0
	20	1	0	1	0	3	0	7	0	11	0	15	0	25	0	44	0	72	0	103	0	154	0	221	0
	50	1	0	1	0	3	0	7	0	11	0	15	0	25	0	44	0	72	0	103	0	166	0	221	0
	100	1	0	1	0	3	0	7	0	11	0	16	0	24	0	47	0	71	0	102	0	163	0	218	0
30	1	1	1	1	2	4	4	8	9	12	14	18	21	29	34	52	61	78	91	113	131	181	210	242	280
	20	1	1	1	2	4	4	8	10	12	14	18	21	29	34	52	61	84	98	112	130	181	210	258	298
	40	1	1	1	2	4	4	8	10	12	14	18	21	29	34	52	61	84	98	112	130	181	210	257	298
	60	1	1	1	2	4	4	8	10	14	16	18	21	29	34	52	61	84	98	112	130	181	210	257	298
50	1	1	1	2	2	5	5	10	11	16	18	23	26	34	39	62	70	100	114	144	163	231	262	308	349
	10	1	1	2	2	5	5	10	11	16	18	23	26	34	39	67	76	100	114	144	163	231	262	308	349
	25	1	1	2	2	5	5	10	11	16	18	23	26	37	42	67	76	108	123	144	163	231	262	329	372
	40	1	1	2	2	5	5	11	12	16	18	23	26	37	42	66	75	107	121	142	161	229	259	325	367
80	1	1	1	2	2	6	7	13	14	21	23	28	31	46	50	82	91	133	147	190	210	305	337	407	449
	5	1	1	2	2	6	7	13	14	21	23	28	31	46	50	82	91	133	147	190	210	305	336	406	449
	15	1	1	2	2	6	7	13	14	21	23	31	34	46	50	89	98	133	147	190	210	305	336	406	449
	25	1	1	2	2	6	7	13	14	21	23	31	34	50	55	89	98	143	158	190	210	305	336	433	478
100	1	1	1	2	3	7	7	14	16	24	26	34	38	56	61	101	110	150	164	216	236	346	377	492	536
	5	1	1	2	3	7	7	14	16	24	26	34	38	56	61	100	110	162	177	216	235	346	377	491	536
	10	1	1	2	3	7	7	16	17	24	26	34	38	56	61	100	110	162	177	216	235	346	377	491	536
	20	1	1	3	3	7	7	16	17	26	28	34	38	56	61	100	110	162	177	231	252	346	377	491	536
200	1	2	2	4	4	11	12	27	29	40	43	58	62	95	100	170	180	274	289	364	385	•••	•••	•••	•••
	5	2	2	4	5	11	12	27	29	44	46	58	62	95	100	170	180	274	289	389	411	•••	•••	•••	•••
	10	2	2	4	5	12	13	27	29	44	46	63	67	95	100	170	180	274	289	389	411	•••	•••	•••	•••
300	1	3	3	6	6	17	17	38	38	61	62	89	90	144	145	257	260	•••	•••	•••	•••	•••	•••	•••	•••
	3	3	3	6	6	17	17	41	42	61	62	89	90	144	145	257	260	•••	•••	•••	•••	•••	•••	•••	•••
	6	3	3	6	7	17	17	41	42	67	68	89	90	144	145	257	260	•••	•••	•••	•••	•••	•••	•••	•••
500	1	5	5	10	10	31	31	73	73	109	110	157	158	253	255	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	5	5	10	10	31	31	73	73	117	118	157	158	252	254	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	4	5	5	11	11	34	34	73	73	117	118	157	158	252	254	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
750	1	8	8	17	17	50	50	107	108	175	175	250	252	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	8	8	17	17	50	50	116	117	188	189	250	252	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
1000	1	10	10	24	24	72	72	155	155	249	250	356	358	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	11	11	24	24	72	72	155	155	249	250	356	358	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
2000	1	24	24	57	57	154	154	354	355	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••

UNIVAC 9200 II System
Memory Size: 32K Bytes

UNISERVO VI C Subsystem: 9 Track
1 Control Unit
3 Tape Units

Table F–1. UNIVAC 9200 II System Sort Program Timing (Part 13 of 16)

Record Size (in bytes)	Blocking Factor	Volume (in thousands)																					
		1		2		5		10		15		20		30		50		75		100		150		200	
		Key Size (in bytes)																					
		10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30
20	1	1	0	1	0	3	0	6	0	9	0	14	0	20	0	38	0	56	0	84	0	125	0	184	0
	20	1	0	1	0	3	0	6	0	9	0	13	0	20	0	37	0	56	0	83	0	124	0	183	0
	50	1	0	1	0	3	0	6	0	10	0	13	0	20	0	37	0	56	0	83	0	124	0	183	0
	100	1	0	1	0	3	0	6	0	10	0	13	0	22	0	37	0	61	0	81	0	122	0	180	0
30	1	1	1	1	2	3	4	6	7	11	13	14	17	24	29	40	47	67	79	89	106	148	176	197	235
	20	1	1	1	2	3	4	6	7	11	13	14	17	24	28	39	47	67	79	88	105	148	176	196	234
	40	1	1	1	2	3	4	6	7	11	13	14	17	24	28	39	47	66	79	88	105	147	176	196	234
	60	1	1	1	2	3	4	7	9	11	13	14	17	24	28	39	47	66	79	88	105	147	176	196	234
50	1	1	1	2	2	4	4	8	10	12	14	19	22	28	32	52	60	77	90	115	133	171	200	229	266
	10	1	1	2	2	4	4	8	10	12	14	18	22	27	32	51	60	77	90	114	133	171	199	228	266
	25	1	1	2	2	4	4	8	10	12	14	18	22	27	32	51	60	77	90	114	133	171	199	252	294
	40	1	1	2	2	4	4	8	9	12	14	18	21	27	31	51	59	76	88	113	131	169	196	249	289
80	1	1	1	2	2	4	5	10	11	16	19	22	25	37	42	61	70	103	117	137	155	228	258	304	344
	5	1	1	2	2	4	5	10	11	16	19	22	25	37	42	61	69	103	117	137	155	228	258	304	344
	15	1	1	2	2	5	6	10	11	16	19	22	25	37	42	61	69	103	117	137	155	228	258	304	344
	25	1	1	2	2	5	6	10	11	16	19	22	25	37	42	61	69	103	117	137	155	228	258	304	344
100	1	1	1	2	2	6	6	11	12	18	20	24	27	41	46	68	76	115	129	153	171	255	285	•••	•••
	5	1	1	2	2	6	6	12	14	18	20	24	27	41	46	68	76	115	129	153	171	255	285	•••	•••
	10	1	1	2	2	6	6	12	14	18	20	24	27	41	46	77	86	115	129	153	171	255	285	•••	•••
	20	1	1	2	2	6	6	12	14	18	20	28	31	41	46	77	86	115	129	170	190	255	285	•••	•••
200	1	2	2	3	3	8	9	18	20	31	33	41	45	70	75	116	125	194	209	•••	•••	•••	•••	•••	•••
	5	2	2	3	3	9	10	18	20	31	33	41	45	70	75	116	125	194	209	•••	•••	•••	•••	•••	•••
	10	2	2	3	4	9	10	18	20	31	33	41	45	70	75	116	125	194	209	•••	•••	•••	•••	•••	•••
300	1	2	2	5	5	13	13	28	29	42	44	64	66	96	99	178	184	•••	•••	•••	•••	•••	•••	•••	•••
	3	2	2	5	5	13	13	28	29	42	44	64	66	96	99	178	184	•••	•••	•••	•••	•••	•••	•••	•••
	6	2	2	5	5	13	13	28	29	42	44	64	66	96	99	178	184	•••	•••	•••	•••	•••	•••	•••	•••
500	1	4	4	7	7	23	23	46	46	78	78	103	104	174	175	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	4	4	7	7	23	23	46	46	78	78	103	104	174	175	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	4	4	4	8	8	23	23	52	52	77	78	103	104	174	175	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
750	1	5	5	12	12	34	34	76	77	114	115	172	172	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	5	5	12	12	34	34	76	77	129	130	172	172	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
1000	1	7	7	15	16	44	45	101	102	171	171	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	8	8	15	16	51	51	101	102	170	171	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
2000	1	18	18	35	35	113	113	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••

UNIVAC 9200 II System
Memory Size: 32K Bytes

UNISERVO VI C Subsystem: 9 Track
1 Control Unit
4 Tape Units

Table F–1. UNIVAC 9200 II System Sort Program Timing (Part 14 of 16)

Record Size (in bytes)	Blocking Factor	Volume (in thousands) 1		2		5		10		15		20		30		50		75		100		150		200	
		Key Size (in bytes) 10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30
20	1	1	0	1	0	3	0	5	0	9	0	12	0	17	0	33	0	50	0	66	0	112	0	149	0
	20	1	0	1	0	3	0	5	0	9	0	12	0	17	0	33	0	49	0	65	0	111	0	148	0
	50	1	0	1	0	3	0	5	0	9	0	12	0	17	0	33	0	49	0	74	0	111	0	148	0
	100	1	0	1	0	3	0	6	0	9	0	11	0	20	0	32	0	48	0	73	0	109	0	145	0
30	1	1	1	1	1	3	3	6	8	9	11	12	15	21	25	35	42	52	62	80	94	119	141	159	188
	20	1	1	1	1	3	3	6	7	9	11	12	14	21	25	35	41	60	71	79	94	119	141	158	188
	40	1	1	1	1	3	3	6	7	9	11	12	14	21	25	35	41	60	71	79	94	119	141	158	188
	60	1	1	1	1	3	3	6	7	9	11	12	14	21	25	35	41	60	71	79	94	119	141	178	211
50	1	1	1	2	2	3	4	7	8	11	12	16	19	24	28	40	47	69	80	92	107	137	160	207	241
	10	1	1	2	2	3	4	7	8	11	12	16	19	24	28	40	46	69	80	91	106	155	180	206	240
	25	1	1	2	2	3	4	7	8	10	12	16	19	24	28	46	53	69	80	91	106	155	180	206	240
	40	1	1	2	2	4	4	7	8	12	14	16	19	24	28	46	53	69	80	91	106	155	180	206	240
80	1	1	1	2	2	4	5	8	9	14	16	19	22	24	32	55	62	81	92	109	123	185	210	247	280
	5	1	1	2	2	4	5	8	9	14	16	19	22	25	32	54	62	81	92	108	123	185	210	247	280
	15	1	1	2	2	4	5	8	9	14	16	19	22	25	32	54	62	81	92	124	140	185	210	247	280
	25	1	1	2	2	4	5	10	11	14	16	19	22	33	37	54	62	81	92	124	140	185	210	247	280
100	1	1	1	2	2	5	5	11	12	16	18	21	24	37	41	61	68	91	102	138	154	207	232	•••	•••
	5	1	1	2	2	5	5	11	12	16	18	21	24	37	41	61	68	91	102	138	154	207	232	•••	•••
	10	1	1	2	2	5	5	11	12	16	18	21	24	37	41	61	68	91	102	138	154	207	232	•••	•••
	20	1	1	2	2	5	5	11	12	16	18	21	24	37	41	61	68	104	116	138	154	207	232	•••	•••
200	1	1	2	3	3	7	7	16	17	23	25	37	39	55	59	105	113	156	169	•••	•••	•••	•••	•••	•••
	5	1	2	3	3	8	9	16	17	28	30	37	39	55	59	105	113	156	169	•••	•••	•••	•••	•••	•••
	10	1	2	3	3	8	9	16	17	28	30	37	39	55	59	105	113	156	169	•••	•••	•••	•••	•••	•••
300	1	2	2	4	4	11	11	22	22	38	39	51	52	76	78	147	149	•••	•••	•••	•••	•••	•••	•••	•••
	3	2	2	4	4	11	11	26	26	38	39	51	52	88	90	147	149	•••	•••	•••	•••	•••	•••	•••	•••
	6	2	2	4	4	11	11	26	26	38	39	51	52	88	90	147	149	•••	•••	•••	•••	•••	•••	•••	•••
500	1	3	3	6	6	17	18	41	42	61	62	95	96	143	144	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	3	3	7	7	17	18	41	42	61	62	95	96	143	144	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	4	3	3	7	7	17	18	41	41	61	62	95	96	142	144	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
750	1	4	4	10	11	30	31	60	61	105	106	140	141	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	4	4	10	11	30	31	60	61	105	106	140	141	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
1000	1	7	7	14	14	40	40	93	94	139	140	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	7	7	14	14	40	40	93	93	139	140	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
2000	1	13	13	32	32	92	92	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••

UNIVAC 9200 II System
Memory Size: 32K Bytes

UNISERVO VI C Subsystem: 9 Track
1 Control Unit
5 Tape Units

Table F—1. UNIVAC 9200 II System Sort Program Timing (Part 15 of 16)

Record Size (in bytes)	Blocking Factor	Volume (in thousands) 1		2		5		10		15		20		30		50		75		100		150		200	
		Key Size (in bytes) 10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30
20	1	1	0	1	0	3	0	6	0	8	0	13	0	19	0	31	0	54	0	72	0	108	0	144	0
	20	1	0	1	0	3	0	6	0	8	0	13	0	19	0	31	0	54	0	72	0	107	0	143	0
	50	1	0	1	0	3	0	6	0	8	0	13	0	19	0	31	0	54	0	72	0	107	0	143	0
	100	1	0	1	0	3	0	6	0	10	0	13	0	19	0	31	0	54	0	72	0	107	0	164	0
30	1	1	1	1	1	3	4	6	7	10	12	13	16	20	24	32	39	57	69	76	92	114	137	175	211
	20	1	1	1	1	3	4	6	7	10	12	13	16	20	23	38	46	57	69	76	91	113	137	174	210
	40	1	1	1	1	3	4	6	7	10	12	13	16	20	23	38	46	57	68	75	91	113	136	174	210
	60	1	1	1	1	3	4	6	7	10	12	13	16	20	23	38	46	57	68	75	91	113	136	174	210
50	1	1	1	1	2	3	4	8	9	11	13	15	18	22	26	44	51	65	77	87	102	150	177	200	237
	10	1	1	1	2	3	4	8	9	11	13	15	18	22	26	43	51	65	77	86	102	150	177	200	236
	25	1	1	1	2	3	4	8	9	11	13	15	18	22	26	43	51	65	77	86	102	150	177	200	236
	40	1	1	1	2	3	4	8	9	11	13	15	18	26	31	43	51	65	77	100	118	150	177	200	236
80	1	1	1	2	2	4	4	9	10	13	15	17	20	31	35	51	58	76	87	118	136	177	203	236	271
	5	1	1	2	2	4	4	9	10	13	15	17	20	31	35	51	58	76	87	118	136	177	203	236	271
	15	1	1	2	2	4	4	9	10	13	15	17	20	31	35	51	58	89	102	118	136	177	203	236	271
	25	1	1	2	2	4	4	9	10	13	15	21	24	31	35	51	58	89	102	118	136	177	203	236	271
100	1	1	1	2	2	4	5	10	11	14	16	23	26	34	38	56	64	98	112	131	149	196	223	•••	•••
	5	1	1	2	2	5	6	10	11	14	16	23	26	34	38	56	64	98	112	131	149	196	223	•••	•••
	10	1	1	2	2	5	6	10	11	14	16	23	26	34	38	56	64	98	112	131	149	196	223	•••	•••
	20	1	1	2	2	5	6	10	11	14	16	23	26	34	38	56	64	98	112	131	149	196	223	•••	•••
200	1	2	2	3	3	7	8	17	18	25	27	33	36	49	54	97	106	145	159	•••	•••	•••	•••	•••	•••
	5	2	2	3	3	7	8	17	18	25	27	33	36	49	54	97	106	145	159	•••	•••	•••	•••	•••	•••
	10	2	2	3	3	7	8	17	18	25	27	33	36	58	64	97	106	146	159	•••	•••	•••	•••	•••	•••
300	1	2	2	4	4	9	10	23	23	34	35	45	46	80	82	134	137	•••	•••	•••	•••	•••	•••	•••	•••
	3	2	2	4	4	9	10	23	23	34	35	45	46	80	82	134	137	•••	•••	•••	•••	•••	•••	•••	•••
	6	2	2	4	4	9	10	23	23	34	35	45	46	80	82	134	137	•••	•••	•••	•••	•••	•••	•••	•••
500	1	3	3	6	6	18	19	36	37	65	66	86	88	129	131	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	3	3	6	6	18	19	36	37	65	66	66	88	129	131	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	4	3	3	6	6	18	19	36	37	65	66	87	88	130	131	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
750	1	5	5	9	9	27	27	64	64	95	96	127	128	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	5	5	9	9	27	27	64	64	95	96	127	128	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
1000	1	6	6	14	14	35	35	84	85	126	127	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	6	6	14	15	35	36	85	85	126	128	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
2000	1	14	14	28	28	84	84	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••

UNIVAC 9200 II System
Memory Size: 32K Bytes

UNISERVO VI C Subsystem: 9 Track
1 Control Unit
6 Tape Units

Table F–1. UNIVAC 9200 II System Sort Program Timing (Part 16 of 16)

Record Size (in bytes)	Blocking Factor	Volume (in thousands)																					
		1		2		5		10		15		20		30		50		75		100		150		200	
		Key Size (in bytes)																					
		10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30
20	1	1	0	1	0	3	0	5	0	8	0	11	0	16	0	29	0	46	0	66	0	104	0	139	0
	20	1	0	1	0	3	0	5	0	8	0	11	0	18	0	31	0	49	0	65	0	104	0	146	0
	50	1	0	1	0	3	0	6	0	8	0	12	0	19	0	33	0	53	0	70	0	111	0	156	0
	100	2	0	3	0	7	0	15	0	24	0	33	0	53	0	93	0	147	0	196	0	310	0	434	0
30	1	1	1	1	1	3	3	7	7	11	11	14	14	22	23	39	41	63	45	83	86	133	137	188	193
	20	1	1	1	1	3	3	7	7	10	11	15	15	24	24	42	43	66	68	88	90	140	143	197	202
	40	1	1	2	2	4	4	9	9	13	13	18	19	29	30	52	53	82	84	109	112	173	177	244	249
	60	1	1	3	3	7	7	14	14	23	23	32	33	51	52	90	92	144	145	191	193	302	305	424	428
50	1	1	1	2	2	5	5	10	10	16	16	23	23	37	37	65	67	105	106	139	142	222	226	314	319
	10	1	1	2	2	5	5	11	11	17	18	25	25	37	37	65	67	105	106	148	151	236	239	314	319
	25	1	1	3	3	7	7	14	14	22	23	32	32	51	51	89	91	142	144	189	192	300	304	423	427
	40	3	3	7	7	19	19	40	40	64	64	85	86	135	136	238	239	375	377	527	529	•••	•••	•••	•••
80	1	2	2	3	3	8	8	16	17	26	27	38	38	61	62	108	110	173	175	231	233	367	371	•••	•••
	5	2	2	3	3	8	8	18	18	28	29	38	38	61	61	108	109	172	174	244	246	366	369	•••	•••
	15	2	2	4	4	11	11	22	23	36	36	51	52	77	77	136	137	217	218	306	309	485	488	•••	•••
	25	5	5	11	11	30	30	68	68	102	02	144	145	228	229	401	402	•••	•••	•••	•••	•••	•••	•••	•••
100	1	2	2	4	4	9	9	22	22	35	35	47	47	75	76	133	135	214	215	302	305	•••	•••	•••	•••
	5	2	2	4	4	10	10	22	22	35	35	50	51	80	81	142	144	227	229	302	305	•••	•••	•••	•••
	10	2	2	4	4	12	12	26	26	41	41	59	59	88	88	156	156	248	250	350	352	•••	•••	•••	•••
	20	7	7	14	14	40	40	85	85	135	136	190	191	301	302	527	528	•••	•••	•••	•••	•••	•••	•••	•••
200	1	4	4	7	7	21	21	45	46	73	74	105	105	168	169	297	299	•••	•••	•••	•••	•••	•••	•••	•••
	5	4	4	9	9	25	25	58	58	86	87	123	123	195	196	345	346	•••	•••	•••	•••	•••	•••	•••	•••
	10	14	14	32	32	85	85	190	191	301	302	401	402	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
300	1	6	6	12	12	34	34	73	73	117	118	167	168	267	267	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	3	6	6	14	14	39	39	83	83	133	133	188	189	283	283	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	6	15	15	33	33	87	88	195	196	309	310	412	413	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
500	1	10	10	21	21	61	61	139	140	209	209	296	297	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	12	12	25	25	72	72	163	163	244	245	345	345	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	4	0	0	0	0	0	0	0	0	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
750	1	17	17	37	37	106	106	224	225	357	357	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	27	27	60	61	160	160	359	359	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
1000	1	27	27	62	62	163	163	365	365	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	0	0	0	0	0	0	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
2000	1	0	0	0	0	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••

UNIVAC 9300/9300 II Systems
Memory Size: 12K Bytes

UNISERVO VI C Subsystem: 9 Track
1 Control Unit
3 Tape Units

Table F–2. UNIVAC 9300/9300 II Systems Tape Sort Timing (Part 1 of 16)

Record Size (in bytes)	Blocking Factor	Volume (in thousands)																					
		1		2		5		10		15		20		30		50		75		100		150		200	
		Key Size (in bytes)																					
		10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30
20	1	1	0	1	0	2	0	4	0	6	0	9	0	13	0	24	0	36	0	53	0	79	0	115	0
	20	1	0	1	0	2	0	4	0	7	0	9	0	15	0	24	0	40	0	53	0	79	0	115	0
	50	1	0	1	0	2	0	5	0	7	0	10	0	15	0	27	0	41	0	54	0	88	0	118	0
	100	1	0	3	0	7	0	14	0	21	0	31	0	46	0	84	0	126	0	184	0	275	0	•••	0
30	1	1	1	1	1	2	3	5	5	8	9	11	12	18	19	29	32	48	52	64	69	105	114	140	151
	20	1	1	1	1	3	3	6	6	8	9	12	13	18	19	33	35	49	52	65	69	106	112	142	150
	40	1	1	1	1	3	3	7	7	11	12	15	15	24	25	40	42	67	69	89	91	146	149	194	199
	60	1	1	2	2	6	6	12	12	20	21	27	27	45	45	74	75	122	124	163	166	267	271	•••	•••
50	1	1	1	2	2	4	4	8	8	12	12	18	18	27	27	49	50	74	75	109	111	163	166	217	221
	10	1	1	2	2	4	4	8	8	14	14	18	18	27	27	49	50	81	83	108	111	162	166	237	242
	25	1	1	2	2	5	6	12	12	18	18	26	27	39	40	72	73	108	110	158	161	237	241	•••	•••
	40	3	3	6	6	17	17	37	38	56	56	82	83	123	124	224	226	336	339	•••	•••	•••	•••	•••	•••
80	1	1	1	2	2	5	6	12	12	20	21	27	28	45	46	75	77	125	127	167	170	275	280	•••	•••
	5	1	1	2	3	6	6	12	12	20	21	27	28	45	46	75	77	125	127	167	170	275	280	•••	•••
	15	2	2	3	3	8	8	18	18	30	30	39	40	66	67	109	111	180	183	240	243	•••	•••	•••	•••
	25	5	5	10	10	30	30	60	60	99	99	131	132	215	217	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
100	1	1	2	3	3	8	8	17	17	25	25	33	33	56	56	92	93	154	156	205	208	•••	•••	•••	•••
	5	1	2	3	3	8	8	17	17	25	25	37	38	56	56	103	104	154	156	226	229	•••	•••	•••	•••
	10	2	2	3	3	9	9	20	20	33	34	44	45	73	74	122	123	201	204	268	272	•••	•••	•••	•••
	20	6	6	12	12	37	38	74	75	123	124	164	165	269	271	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
200	1	3	3	5	5	16	16	32	32	54	54	72	72	120	121	200	201	•••	•••	•••	•••	•••	•••	•••	•••
	5	3	3	7	7	19	19	43	43	72	73	96	97	144	145	265	266	•••	•••	•••	•••	•••	•••	•••	•••
	10	14	14	30	30	82	83	180	181	269	271	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
300	1	4	4	9	9	24	24	54	54	81	81	120	121	180	180	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	3	5	5	10	10	31	31	62	62	103	104	138	138	228	229	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	6	12	12	26	26	72	72	158	159	237	239	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
500	1	7	7	16	16	45	45	100	100	150	151	221	221	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	10	10	19	19	60	61	120	121	198	200	265	266	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	4	0	0	0	0	0	0	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
750	1	13	13	26	26	81	82	162	163	269	270	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	23	23	50	51	138	139	302	303	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
1000	1	22	22	48	49	133	133	290	291	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	0	0	0	0	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
2000	1	0	0	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••

UNIVAC 9200 II System
Memory Size: 12K Bytes

UNISERVO VI C Subsystem: 9 Track
1 Control Unit
4 Tape Units

Table F–2. UNIVAC 9300/9300 II Systems Tape Sort Timing (Part 2 of 16)

Record Size (in bytes)	Blocking Factor	Volume (in thousands) 1		2		5		10		15		20		30		50		75		100		150		200	
		Key Size (in bytes) 10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30
20	1	1	0	1	0	2	0	4	0	5	0	7	0	12	0	20	0	33	0	44	0	66	0	98	0
	20	1	0	1	0	2	0	4	0	5	0	8	0	12	0	22	0	33	0	44	0	73	0	97	0
	50	1	0	1	0	2	0	4	0	7	0	9	0	13	0	25	0	38	0	56	0	84	0	112	0
	100	1	0	3	0	6	0	14	0	21	0	33	0	49	0	92	0	137	0	183	0	•••	0	•••	0
30	1	1	1	1	1	2	2	5	5	7	7	10	11	15	16	29	30	43	45	57	59	96	100	127	133
	20	1	1	1	1	3	3	5	5	8	9	11	11	16	17	30	31	45	47	68	70	101	105	135	140
	40	1	1	1	1	3	3	7	7	10	11	13	14	23	24	38	39	64	66	86	88	128	132	192	197
	60	1	1	2	2	6	6	14	14	20	21	27	27	46	47	76	78	129	131	172	175	•••	•••	•••	•••
50	1	1	1	1	2	4	4	7	7	11	12	15	16	22	23	43	44	64	66	98	100	146	150	195	200
	10	1	1	2	2	4	4	8	8	12	12	16	16	27	28	44	46	76	78	101	103	151	155	226	231
	25	1	1	2	2	6	6	11	11	19	19	25	25	37	37	70	71	104	106	139	142	235	239	•••	•••
	40	3	3	6	6	18	18	40	41	60	61	80	81	136	137	226	228	•••	•••	•••	•••	•••	•••	•••	•••
80	1	1	1	2	2	5	5	12	12	17	18	26	27	39	48	65	67	112	114	149	152	•••	•••	•••	•••
	5	1	1	2	2	5	5	12	12	17	18	27	27	40	40	75	77	113	115	150	153	•••	•••	•••	•••
	15	1	2	3	3	8	8	19	19	28	28	37	37	63	64	105	106	157	159	237	240	•••	•••	•••	•••
	25	5	5	12	12	28	28	64	65	96	97	145	146	217	218	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
100	1	1	1	3	3	6	6	14	14	21	21	32	33	48	49	92	94	138	140	184	187	•••	•••	•••	•••
	5	1	1	3	3	7	8	14	15	25	26	33	34	50	51	95	97	143	144	190	193	•••	•••	•••	•••
	10	2	2	3	3	9	9	21	21	31	31	41	41	70	71	116	118	174	176	•••	•••	•••	•••	•••	•••
	20	6	6	14	14	40	41	80	81	136	137	181	182	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
200	1	3	3	5	5	14	14	31	32	47	47	62	63	108	108	179	180	•••	•••	•••	•••	•••	•••	•••	•••
	5	3	3	7	7	20	20	40	40	69	70	92	93	138	139	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	10	14	14	32	33	91	91	181	182	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
300	1	4	4	8	8	24	24	47	47	81	81	108	108	161	162	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	3	4	4	10	10	29	29	66	66	99	99	131	132	223	224	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	6	13	13	26	26	74	75	168	169	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
500	1	7	7	14	14	41	41	93	94	140	140	186	187	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	9	9	20	20	50	50	115	116	172	173	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	4	0	0	0	0	0	0	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
750	1	12	12	27	27	77	77	153	154	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	22	22	50	50	141	142	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
1000	1	20	20	40	40	115	116	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	0	0	0	0	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
2000	1	0	0	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••

UNIVAC 9300/9300 II Systems
Memory Size: 12K Bytes

UNISERVO VI C Subsystem: 9 Track
1 Control Unit
5 Tape Units

Table F–2. UNIVAC 9300/9300 II Systems Tape Sort Timing (Part 3 of 16)

Record Size (in bytes)	Blocking Factor	Volume (in thousands)																					
		1		2		5		10		15		20		30		50		75		100		150		200	
		Key Size (in bytes)																					
		10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30
20	1	1	0	1	0	2	0	4	0	6	0	8	0	12	0	22	0	33	0	44	0	66	0	99	0
	20	1	0	1	0	2	0	4	0	6	0	8	0	12	0	22	0	33	0	44	0	75	0	100	0
	50	1	0	1	0	2	0	5	0	7	0	9	0	15	0	25	0	38	0	58	0	86	0	115	0
	100	1	0	3	0	8	0	16	0	24	0	37	0	55	0	92	0	158	0	211	0	***	0	***	0
30	1	1	1	1	1	2	3	5	5	7	8	10	10	14	15	28	29	41	44	55	58	94	99	125	132
	20	1	1	1	1	3	3	5	6	8	8	10	11	18	19	30	31	45	47	68	71	102	107	136	142
	40	1	1	2	2	4	4	7	7	10	10	16	16	23	24	38	40	67	69	89	92	133	137	177	183
	60	1	1	3	3	6	6	14	15	21	22	28	29	50	51	83	85	124	126	190	195	***	***	***	***
50	1	1	1	2	2	3	3	7	8	11	11	14	15	25	26	41	43	62	64	96	99	144	148	192	197
	10	1	1	2	2	3	3	8	8	11	12	18	18	26	27	44	45	76	79	102	105	152	157	***	***
	25	1	1	2	2	6	6	11	11	19	19	25	26	37	38	73	74	109	111	145	148	***	***	***	***
	40	4	4	7	7	20	20	46	47	69	70	92	93	158	160	***	***	***	***	***	***	***	***	***	***
80	1	1	1	2	2	6	6	11	11	16	16	25	26	38	39	63	64	110	113	147	150	***	***	***	***
	5	1	1	2	2	6	6	11	11	20	20	26	27	39	40	76	77	113	116	151	154	***	***	***	***
	15	2	2	3	3	8	8	19	19	28	29	37	38	66	67	109	111	164	166	***	***	***	***	***	***
	25	6	6	13	13	31	32	73	74	110	111	169	171	***	***	***	***	***	***	***	***	***	***	***	***
100	1	1	2	2	3	7	7	13	13	23	24	31	32	46	47	91	92	136	139	181	184	***	***	***	***
	5	2	2	3	3	7	7	14	14	25	25	33	33	49	50	96	98	144	146	***	***	***	***	***	***
	10	2	2	4	4	9	9	21	21	31	31	41	41	72	73	120	121	179	182	***	***	***	***	***	***
	20	7	7	16	16	46	47	92	93	158	160	211	213	***	***	***	***	***	***	***	***	***	***	***	***
200	1	2	2	5	5	13	13	30	31	45	46	60	61	106	107	177	178	***	***	***	***	***	***	***	***
	5	3	3	7	7	21	21	41	41	72	73	96	97	143	145	***	***	***	***	***	***	***	***	***	***
	10	16	16	37	37	106	107	211	213	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
300	1	3	3	8	8	23	23	45	46	80	81	106	107	159	161	***	***	***	***	***	***	***	***	***	***
	3	5	5	10	10	29	29	68	69	102	103	136	137	***	***	***	***	***	***	***	***	***	***	***	***
	6	14	14	28	28	82	83	189	191	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
500	1	7	7	13	14	40	41	95	96	142	143	***	***	***	***	***	***	***	***	***	***	***	***	***	***
	2	9	9	21	21	51	51	120	121	179	181	***	***	***	***	***	***	***	***	***	***	***	***	***	***
	4	0	0	0	0	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
750	1	11	11	27	27	79	80	158	159	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
	2	23	23	54	54	153	155	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
1000	1	21	21	41	41	120	121	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
	2	0	0	0	0	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
2000	1	0	0	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***

UNIVAC 9300/9300 II Systems
Memory Size: 12K Bytes

UNISERVO VI C Subsystem: 9 Track
1 Control Unit
4 Tape Units

Table F–2. UNIVAC 9300/9300 II Systems Tape Sort Timing (Part 4 of 16)

Record Size (in bytes)	Blocking Factor	Volume (in thousands)																							
		1		2		5		10		15		20		30		50		75		100		150		200	
		Key Size (in bytes)																							
		10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30
20	1	1	0	1	0	2	0	5	0	7	0	10	0	16	0	29	0	43	0	61	0	97	0	137	0
	20	1	0	1	0	2	0	5	0	7	0	10	0	16	0	29	0	45	0	60	0	96	0	136	0
	50	1	0	1	0	2	0	5	0	8	0	11	0	17	0	30	0	45	0	64	0	101	0	134	0
	100	1	0	1	0	3	0	6	0	8	0	12	0	19	0	33	0	53	0	70	0	111	0	156	0
30	1	1	1	1	1	3	3	6	6	9	10	11	13	18	20	33	36	52	58	74	82	111	123	157	174
	20	1	1	1	1	3	3	6	6	9	10	12	14	20	22	35	39	55	62	74	82	117	131	166	184
	40	1	1	1	1	3	3	6	7	10	10	13	14	20	22	36	39	57	62	80	88	127	139	170	185
	60	1	1	2	2	3	3	7	7	11	12	15	16	24	25	42	44	68	69	95	98	143	146	201	206
50	1	1	1	2	2	4	4	9	9	14	15	19	19	30	31	54	55	86	88	115	118	184	188	261	266
	10	1	1	2	2	4	4	9	9	14	15	20	21	30	31	54	55	86	88	123	126	196	200	261	266
	25	1	1	2	2	4	4	10	10	16	16	21	21	33	34	59	60	95	96	134	137	213	217	284	289
	40	1	1	2	2	6	6	13	13	20	20	27	27	43	43	76	77	121	122	171	173	271	274	361	364
80	1	1	1	2	2	6	6	14	15	21	22	31	31	50	50	89	90	142	144	189	191	301	305	427	431
	5	1	1	3	3	6	6	14	15	23	24	31	31	50	50	89	90	141	144	201	203	301	305	427	431
	15	1	1	3	3	7	7	16	16	26	26	34	34	54	55	97	98	154	156	206	207	327	330	***	***
	25	2	2	3	3	9	9	21	21	33	34	44	45	71	72	126	127	200	202	283	285	424	427	***	***
100	1	1	1	3	3	8	8	18	18	28	29	38	38	61	62	109	110	175	177	249	251	396	400	***	***
	5	2	2	3	3	8	8	18	18	28	29	41	41	66	66	117	118	187	189	249	251	396	400	***	***
	10	2	2	3	3	8	8	19	19	31	31	41	41	65	66	117	118	186	188	264	266	418	422	***	***
	20	2	2	4	4	12	12	26	26	41	41	59	59	88	88	156	156	248	250	350	352	***	***	***	***
200	1	3	3	6	6	17	17	37	37	59	60	85	86	137	138	243	245	387	390	***	***	***	***	***	***
	5	3	3	6	7	19	19	40	40	64	64	91	92	146	147	258	260	387	389	***	***	***	***	***	***
	10	4	4	9	9	25	25	58	58	86	87	123	123	195	196	345	346	***	***	***	***	***	***	***	***
300	1	4	4	9	9	27	27	59	59	95	95	135	136	217	218	384	386	***	***	***	***	***	***	***	***
	3	4	4	10	10	27	27	63	64	102	102	135	136	217	218	384	386	***	***	***	***	***	***	***	***
	6	6	6	13	13	38	38	80	81	129	129	182	183	273	274	***	***	***	***	***	***	***	***	***	***
500	1	8	8	17	17	49	49	113	113	169	169	241	241	384	385	***	***	***	***	***	***	***	***	***	***
	2	8	8	18	18	53	53	113	113	181	181	256	257	384	385	***	***	***	***	***	***	***	***	***	***
	4	12	12	25	25	72	72	163	163	244	245	345	345	***	***	***	***	***	***	***	***	***	***	***	***
750	1	13	13	27	27	79	79	181	181	271	271	384	385	***	***	***	***	***	***	***	***	***	***	***	***
	2	15	15	32	32	93	93	210	211	315	316	***	***	***	***	***	***	***	***	***	***	***	***	***	***
1000	1	18	18	39	39	113	113	256	257	384	385	***	***	***	***	***	***	***	***	***	***	***	***	***	***
	2	27	27	62	62	163	163	365	365	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
2000	1	0	0	0	0	0	0	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***

UNIVAC 9300/9300 II Systems
Memory Size: 16K Bytes

UNISERVO VI C Subsystem: 9 Track
1 Control Unit
3 Tape Units

Table F–2. UNIVAC 9300/9300 II Systems Tape Sort Timing (Part 5 of 16)

Record Size (in bytes)	Blocking Factor	Volume (in thousands) / Key Size (in bytes)																					
		1		2		5		10		15		20		30		50		75		100		150		200	
		10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30
20	1	1	0	1	0	2	0	4	0	6	0	8	0	13	0	22	0	36	0	47	0	78	0	104	0
	20	1	0	1	0	2	0	4	0	6	0	8	0	13	0	24	0	35	0	47	0	77	0	103	0
	50	1	0	1	0	2	0	4	0	6	0	9	0	13	0	24	0	35	0	51	0	77	0	112	0
	100	1	0	1	0	2	0	5	0	7	0	10	0	15	0	27	0	41	0	54	0	88	0	118	0
30	1	1	1	1	1	2	3	5	5	7	8	10	11	14	17	26	31	39	46	58	68	87	102	115	135
	20	1	1	1	1	2	3	5	5	7	9	10	11	14	17	26	30	43	50	57	67	85	100	124	146
	40	1	1	1	1	3	3	5	5	8	9	10	11	17	19	27	31	45	51	60	68	98	111	131	148
	60	1	1	1	1	3	3	6	6	9	9	13	13	19	19	34	36	51	53	75	78	113	116	150	155
50	1	1	1	1	1	3	3	6	7	11	11	14	14	23	24	38	40	64	66	85	88	141	145	187	193
	10	1	1	1	2	3	4	6	7	11	11	14	14	23	24	38	40	64	66	85	88	141	145	187	192
	25	1	1	2	2	4	4	8	8	11	12	17	17	25	26	46	47	69	71	102	104	152	156	223	228
	40	1	1	2	2	5	5	11	11	16	16	21	21	35	35	57	58	95	97	127	129	209	213	278	283
80	1	1	1	2	2	5	5	10	11	15	16	23	24	35	35	64	66	96	98	143	145	214	217	•••	•••
	5	1	1	2	2	5	5	10	11	15	16	23	24	35	35	64	66	96	98	143	145	214	217	•••	•••
	15	1	1	2	2	6	6	11	12	19	19	26	26	42	43	70	71	116	118	155	157	254	259	•••	•••
	25	1	1	3	3	7	7	16	16	27	27	36	36	53	54	98	100	148	150	217	220	•••	•••	•••	•••
100	1	1	1	2	2	6	6	13	13	21	22	28	29	42	43	79	80	118	120	175	178	•••	•••	•••	•••
	5	1	1	2	2	6	6	13	13	21	22	28	29	48	48	79	80	132	134	175	178	•••	•••	•••	•••
	10	1	1	3	3	7	7	15	15	22	23	29	30	49	50	82	83	137	139	182	184	•••	•••	•••	•••
	20	2	2	3	3	9	9	20	20	33	34	44	45	73	74	122	123	201	204	268	272	•••	•••	•••	•••
200	1	2	2	4	4	12	12	27	28	41	41	61	62	91	92	169	171	•••	•••	•••	•••	•••	•••	•••	•••
	5	2	2	5	5	13	13	28	29	48	48	64	64	107	107	177	179	•••	•••	•••	•••	•••	•••	•••	•••
	10	3	3	7	7	19	19	43	43	72	73	96	97	144	145	265	266	•••	•••	•••	•••	•••	•••	•••	•••
300	1	3	3	6	6	20	20	40	40	68	68	91	91	151	152	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	3	3	3	8	8	21	21	47	47	70	70	104	104	155	156	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	6	5	5	9	10	30	30	59	60	99	100	132	133	219	220	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
500	1	5	5	12	12	33	34	75	76	126	127	168	168	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	6	7	12	13	40	40	79	79	132	133	176	176	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	4	10	10	19	19	60	61	120	121	198	200	265	266	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
750	1	9	9	20	20	57	57	126	127	189	190	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	12	12	24	24	75	75	149	150	247	249	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
1000	1	14	14	28	28	88	88	176	176	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	22	22	48	49	133	133	290	291	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
2000	1	43	43	96	97	265	266	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••

UNIVAC 9300/9300 II Systems
Memory Size: 16K Bytes

UNISERVO VI C Subsystem: 9 Track
1 Control Unit
4 Tape Units

Table F–2. UNIVAC 9300/9300 II Systems Tape Sort Timing (Part 6 of 16)

Record Size (in bytes)	Blocking Factor	Volume (in thousands)																					
		1		2		5		10		15		20		30		50		75		100		150		200	
		Key Size (in bytes)																					
		10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30
20	1	1	0	1	0	2	0	3	0	5	0	7	0	12	0	19	0	29	0	43	0	65	0	86	0
	20	1	0	1	0	2	0	4	0	5	0	7	0	12	0	19	0	29	0	43	0	64	0	85	0
	50	1	0	1	0	2	0	4	0	5	0	7	0	12	0	19	0	32	0	43	0	64	0	95	0
	100	1	0	1	0	2	0	4	0	7	0	9	0	13	0	25	0	38	0	56	0	84	0	112	0
30	1	1	1	1	1	2	2	4	5	6	7	8	9	14	15	22	25	37	42	50	56	74	84	111	125
	20	1	1	1	1	2	2	4	5	6	7	9	10	13	15	22	25	37	41	49	55	73	82	109	123
	40	1	1	1	1	3	3	5	5	8	8	10	10	15	15	27	29	41	43	54	57	91	95	122	127
	60	1	1	1	1	3	3	6	6	9	9	11	12	19	20	32	33	47	49	71	74	107	110	142	147
50	1	1	1	1	1	3	3	6	6	9	9	13	14	19	20	37	38	55	57	74	76	125	129	167	172
	10	1	1	1	1	3	3	6	6	10	10	13	14	19	20	37	38	55	57	74	76	125	129	166	172
	25	1	1	1	2	3	4	8	8	11	11	15	15	25	26	42	43	62	64	94	97	141	145	188	193
	40	1	1	2	2	4	4	10	10	14	14	22	22	32	33	61	63	91	93	122	125	205	209	•••	•••
80	1	1	1	2	2	4	5	8	9	15	15	19	20	33	34	55	56	82	84	126	128	188	192	•••	•••
	5	1	1	2	2	4	5	10	10	15	15	19	20	33	34	55	56	82	84	126	128	188	192	•••	•••
	15	1	1	2	2	5	5	11	11	16	17	25	26	38	38	62	64	107	109	142	145	•••	•••	•••	•••
	25	1	1	3	3	7	7	14	14	25	25	33	33	49	50	94	95	141	143	212	215	•••	•••	•••	•••
100	1	1	1	2	2	5	5	12	12	18	18	23	24	41	42	68	69	116	118	154	157	•••	•••	•••	•••
	5	1	1	2	2	5	5	12	12	18	18	23	24	41	42	68	69	116	118	154	157	•••	•••	•••	•••
	10	1	1	3	3	6	6	13	13	19	19	30	30	44	45	84	85	125	128	167	170	•••	•••	•••	•••
	20	2	2	3	3	9	9	21	21	31	31	41	41	70	71	116	118	174	176	•••	•••	•••	•••	•••	•••
200	1	2	2	4	4	11	12	22	23	39	39	52	52	77	78	149	150	•••	•••	•••	•••	•••	•••	•••	•••
	5	2	2	4	4	12	12	28	29	42	43	56	57	97	98	161	163	•••	•••	•••	•••	•••	•••	•••	•••
	10	3	3	7	7	20	20	40	40	69	70	92	93	138	139	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
300	1	3	3	6	6	17	17	39	39	58	58	77	77	133	133	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	3	3	3	6	6	18	18	41	41	62	62	95	95	142	142	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	6	4	4	10	10	28	28	63	63	94	95	125	126	213	214	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
500	1	5	5	11	11	32	32	64	64	111	111	148	148	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	5	5	12	12	35	35	81	81	121	122	161	162	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	4	9	9	20	20	50	50	115	116	172	173	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
750	1	9	9	17	17	50	50	114	115	172	172	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	11	11	25	25	70	70	140	140	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
1000	1	12	12	28	28	81	81	161	162	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	20	20	40	40	115	116	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
2000	1	40	40	92	93	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••

UNIVAC 9300/9300 II Systems
Memory Size: 16K Bytes

UNISERVO VI C Subsystem: 9 Track
1 Control Unit
5 Tape Units

Table F–2. UNIVAC 9300/9300 II Systems Tape Sort TIming (Part 7 of 16)

Record Size (in bytes)	Blocking Factor	Volume (in thousands) 1		2		5		10		15		20		30		50		75		100		150		200	
		Key Size (in bytes) 10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30
20	1	1	0	1	0	2	0	4	0	5	0	8	0	11	0	19	0	32	0	43	0	64	0	85	0
	20	1	0	1	0	2	0	4	0	5	0	8	0	11	0	19	0	32	0	43	0	64	0	85	0
	50	1	0	1	0	2	0	4	0	6	0	8	0	11	0	22	0	32	0	43	0	64	0	97	0
	100	1	0	1	0	2	0	5	0	7	0	9	0	15	0	25	0	38	0	58	0	86	0	115	0
30	1	1	1	1	1	2	3	4	5	7	8	9	10	13	15	21	25	36	42	47	56	71	84	108	128
	20	1	1	1	1	2	2	4	4	7	8	9	10	13	15	24	28	36	42	47	55	81	95	108	126
	40	1	1	1	1	2	3	5	5	7	8	9	10	14	16	27	29	40	43	53	57	91	98	122	131
	60	1	1	1	1	3	3	6	6	8	9	11	11	19	20	32	33	47	49	73	75	109	113	145	150
50	1	1	1	1	1	3	3	6	7	9	10	12	13	18	19	35	37	52	55	70	73	121	125	161	167
	10	1	1	1	1	3	3	6	7	9	10	12	13	21	22	35	37	53	55	70	73	121	126	161	167
	25	1	1	2	2	3	3	7	7	11	11	14	14	25	25	41	42	61	63	94	97	141	146	188	194
	40	1	1	2	2	5	5	9	10	16	17	22	22	32	33	63	64	94	96	125	128	188	192	•••	•••
80	1	1	1	2	2	4	4	9	9	13	14	18	18	31	32	52	53	78	80	121	124	182	186	•••	•••
	5	1	1	2	2	4	4	9	9	13	14	18	18	31	32	52	53	91	93	121	124	182	186	•••	•••
	15	1	1	2	2	5	6	10	11	19	19	25	25	37	38	61	62	107	109	142	146	•••	•••	•••	•••
	25	2	2	3	3	7	7	17	17	25	25	33	34	49	50	97	99	145	147	•••	•••	•••	•••	•••	•••
100	1	1	1	2	2	5	5	11	11	16	17	26	26	38	39	64	65	112	114	149	152	•••	•••	•••	•••
	5	1	1	2	2	6	6	11	11	16	17	26	26	39	39	64	65	112	114	149	152	•••	•••	•••	•••
	10	1	1	2	2	6	6	12	12	22	22	29	29	43	44	83	85	125	127	166	169	•••	•••	•••	•••
	20	2	2	4	4	9	9	21	21	31	31	41	41	72	73	120	121	179	182	•••	•••	•••	•••	•••	•••
200	1	2	2	4	4	10	10	25	25	37	37	49	49	73	74	143	145	•••	•••	•••	•••	•••	•••	•••	•••
	5	2	2	5	5	12	12	28	28	41	42	55	55	97	98	161	162	•••	•••	•••	•••	•••	•••	•••	•••
	10	3	3	7	7	21	21	41	41	72	73	96	97	143	145	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
300	1	3	3	6	6	15	15	37	37	55	55	73	73	129	130	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	3	3	3	7	7	20	21	40	41	60	61	95	95	141	143	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	6	5	5	9	9	28	28	55	55	97	98	129	130	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
500	1	5	5	10	10	31	31	61	61	108	109	144	145	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	6	6	12	12	34	35	81	91	121	122	161	162	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	4	9	9	21	21	51	51	120	121	179	181	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
750	1	8	8	20	20	48	49	114	115	171	172	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	10	10	24	25	60	61	142	143	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
1000	1	12	12	28	28	81	91	161	162	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	21	21	41	41	120	121	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
2000	1	41	41	96	97	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••

UNIVAC 9300/9300 II Systems
Memory Size: 16K Bytes

UNISERVO VI C Subsystem: 9 Track
1 Control Unit
6 Tape Units

Table F–2. UNIVAC 9300/9300 II Systems Tape Sort Timing (Part 8 of 16)

Record Size (in bytes)	Blocking Factor	Volume (in thousands)																					
		1		2		5		10		15		20		30		50		75		100		150		200	
		Key Size (in bytes)																					
		10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30
20	1	1	0	1	0	2	0	4	0	7	0	9	0	14	0	24	0	39	0	52	0	83	0	118	0
	20	1	0	1	0	2	0	4	0	6	0	8	0	14	0	24	0	39	0	55	0	83	0	118	0
	50	1	0	1	0	2	0	4	0	6	0	8	0	14	0	24	0	39	0	55	0	88	0	118	0
	100	1	0	1	0	2	0	4	0	6	0	9	0	14	0	26	0	41	0	55	0	87	0	124	0
30	1	1	1	1	1	2	3	4	5	7	8	10	12	15	17	29	33	43	50	62	71	99	114	131	152
	20	1	1	1	1	2	3	4	5	7	8	10	11	16	18	28	33	46	53	61	70	97	112	138	159
	40	1	1	1	1	2	3	5	6	8	9	10	11	16	18	28	33	46	53	61	70	97	112	138	159
	60	1	1	1	1	2	3	5	6	8	9	10	11	16	18	28	33	46	53	65	75	104	119	138	159
50	1	1	1	1	1	3	3	6	7	10	11	13	14	22	22	39	40	62	65	89	92	143	147	191	196
	10	1	1	1	1	3	3	6	7	10	11	15	15	22	22	39	40	62	64	89	92	143	147	190	196
	25	1	1	1	1	3	3	6	7	10	11	15	15	23	24	42	43	67	69	89	92	143	147	203	208
	40	1	1	1	1	3	3	7	7	11	11	14	15	23	24	41	43	66	68	95	97	142	145	201	206
80	1	1	1	2	2	4	4	10	10	16	17	21	22	35	36	63	64	101	103	145	147	217	220	309	313
	5	1	1	2	2	5	5	10	10	16	17	21	22	35	36	63	64	101	103	145	147	232	235	309	313
	15	1	1	2	2	5	5	10	10	16	17	23	24	38	39	68	69	101	103	145	147	232	235	309	313
	25	1	1	2	2	5	5	11	11	16	17	23	24	38	39	68	69	109	110	145	147	232	235	328	333
100	1	1	1	2	2	6	6	12	12	20	20	29	29	46	47	83	84	124	126	178	180	285	288	***	***
	5	1	1	2	2	6	6	12	12	20	20	29	29	46	47	83	84	133	135	178	180	285	288	***	***
	10	1	1	2	2	6	6	13	14	20	20	29	29	46	47	83	84	133	135	178	180	285	288	***	***
	20	1	1	2	2	6	6	13	14	22	22	29	29	46	47	83	84	133	135	190	192	303	307	***	***
200	1	2	2	4	4	11	12	27	28	41	41	59	59	96	96	172	173	276	277	***	***	***	***	***	***
	5	2	2	4	4	11	12	27	28	44	45	59	59	96	96	172	173	276	277	***	***	***	***	***	***
	10	2	2	4	4	13	13	27	28	44	45	64	64	103	104	184	185	294	296	***	***	***	***	***	***
300	1	3	3	6	6	18	19	40	40	66	66	95	95	153	154	273	274	***	***	***	***	***	***	***	***
	3	3	3	6	6	18	19	44	44	71	71	95	95	153	153	273	274	***	***	***	***	***	***	***	***
	6	3	3	7	7	20	20	44	44	71	71	102	102	153	153	273	274	***	***	***	***	***	***	***	***
500	1	5	5	11	11	33	33	78	79	117	117	168	169	271	271	***	***	***	***	***	***	***	***	***	***
	2	5	5	11	11	33	33	78	79	126	127	168	169	271	271	***	***	***	***	***	***	***	***	***	***
	4	6	6	12	12	36	36	78	78	126	126	180	181	289	290	***	***	***	***	***	***	***	***	***	***
750	1	8	8	18	18	54	54	126	126	189	189	270	270	***	***	***	***	***	***	***	***	***	***	***	***
	2	8	8	20	20	54	54	126	126	203	203	270	270	***	***	***	***	***	***	***	***	***	***	***	***
1000	1	12	12	27	27	78	78	168	168	270	270	***	***	***	***	***	***	***	***	***	***	***	***	***	***
	2	12	12	29	29	78	78	180	180	289	289	***	***	***	***	***	***	***	***	***	***	***	***	***	***
2000	1	29	29	63	63	180	180	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***

UNIVAC 9300/9300 II Systems
Memory Size: 24K Bytes

UNISERVO VI C Subsystem: 9 Track
1 Control Unit
3 Tape Units

Table F–2. UNIVAC 9300/9300 II Systems Tape Sort Timing (Part 9 of 16)

Record Size (in bytes)	Blocking Factor	Volume (in thousands)																					
		1		2		5		10		15		20		30		50		75		100		150		200	
		Key Size (in bytes)																					
		10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30
20	1	1	0	1	0	2	0	3	0	5	0	7	0	12	0	19	0	31	0	42	0	69	0	92	0
	20	1	0	1	0	2	0	4	0	5	0	7	0	11	0	19	0	31	0	41	0	69	0	91	0
	50	1	0	1	0	2	0	4	0	5	0	8	0	11	0	21	0	31	0	41	0	69	0	91	0
	100	1	0	1	0	2	0	4	0	5	0	8	0	11	0	21	0	31	0	46	0	69	0	101	0
30	1	1	1	1	1	2	2	4	5	6	7	8	10	12	15	23	27	34	41	50	60	75	90	100	119
	20	1	1	1	1	2	2	4	5	6	7	8	10	12	15	23	27	34	40	50	60	75	89	110	131
	40	1	1	1	1	2	2	4	5	6	7	8	10	12	14	22	27	33	40	50	59	74	88	109	129
	60	1	1	1	1	2	2	4	5	6	7	8	10	14	16	22	27	37	44	50	59	74	88	109	129
50	1	1	1	1	1	2	2	5	5	8	8	10	11	17	18	28	30	46	51	62	67	102	111	137	148
	10	1	1	1	1	3	3	5	5	8	8	10	11	17	18	28	30	46	51	62	67	102	111	136	148
	25	1	1	1	1	3	3	5	6	8	8	10	11	17	18	28	30	46	51	62	67	102	111	136	148
	40	1	1	1	1	3	3	5	6	8	8	11	12	17	18	31	34	47	51	69	74	103	111	138	148
80	1	1	1	1	2	3	4	7	8	11	11	17	17	25	25	46	47	69	71	102	105	153	157	203	209
	5	1	1	1	1	3	4	7	8	11	11	16	17	24	25	45	47	68	70	101	104	152	155	202	207
	15	1	1	1	1	3	4	7	8	11	11	16	17	24	25	45	47	68	70	101	104	152	155	223	228
	25	1	1	1	2	3	4	7	8	13	13	17	17	28	29	46	47	77	79	102	105	169	173	226	231
100	1	1	1	2	2	4	4	9	9	13	13	20	20	29	30	55	57	83	85	124	126	185	189	•••	•••
	5	1	1	2	2	4	4	9	9	15	15	20	20	29	30	55	57	93	95	124	126	185	189	•••	•••
	10	1	1	2	2	4	4	9	9	15	15	20	20	33	34	55	57	93	95	124	126	205	209	•••	•••
	20	1	1	2	2	5	5	9	9	15	15	20	20	34	35	56	57	94	96	125	128	207	212	•••	•••
200	1	2	2	3	3	8	8	19	19	28	28	42	42	63	63	118	119	176	178	•••	•••	•••	•••	•••	•••
	5	2	2	3	3	8	8	19	19	28	28	42	42	63	63	118	119	176	178	•••	•••	•••	•••	•••	•••
	10	2	2	3	3	8	8	19	19	32	32	42	43	72	72	119	120	198	201	•••	•••	•••	•••	•••	•••
300	1	2	2	4	4	12	12	27	27	46	47	62	62	104	105	173	175	•••	•••	•••	•••	•••	•••	•••	•••
	3	2	2	4	4	14	14	27	27	46	47	62	62	104	105	173	175	•••	•••	•••	•••	•••	•••	•••	•••
	6	2	2	5	5	14	14	31	31	46	47	70	70	104	105	194	194	•••	•••	•••	•••	•••	•••	•••	•••
500	1	4	4	8	8	22	22	51	51	76	76	114	115	171	172	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	4	4	8	8	22	22	51	51	86	86	114	115	171	172	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	4	4	4	8	8	26	26	51	51	87	87	116	116	193	194	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
750	1	6	6	14	14	38	38	86	86	128	129	171	171	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	6	6	14	14	38	38	86	86	128	129	191	191	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
1000	1	8	8	18	18	51	51	114	114	171	171	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	8	8	18	18	51	51	116	116	193	194	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
2000	1	18	18	41	41	116	116	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••

UNIVAC 9300/9300 II Systems
Memory Size: 24K Bytes

UNISERVO VI C Subsystem: 9 Track
1 Control Unit
4 Tape Units

Table F–2. UNIVAC 9300/9300 II Systems Tape Sort Timing (Part 10 of 16)

Record Size (in bytes)	Blocking Factor	Volume (in thousands)																					
		1		2		5		10		15		20		30		50		75		100		150		200	
		Key Size (in bytes)																					
		10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30
20	1	1	0	1	0	2	0	3	0	5	0	6	0	10	0	17	0	28	0	38	0	56	0	84	0
	20	1	0	1	0	2	0	3	0	5	0	6	0	10	0	17	0	28	0	37	0	56	0	83	0
	50	1	0	1	0	2	0	3	0	5	0	7	0	10	0	17	0	28	0	37	0	56	0	83	0
	100	1	0	1	0	2	0	3	0	5	0	7	0	10	0	19	0	28	0	37	0	63	0	83	0
30	1	1	1	1	1	2	2	3	4	5	6	8	9	11	13	18	21	31	36	41	48	69	81	91	108
	20	1	1	1	1	2	2	3	4	5	6	7	9	11	13	21	24	31	36	41	48	68	81	91	108
	40	1	1	1	1	2	2	3	4	6	7	7	9	11	13	20	24	30	35	40	47	67	79	89	106
	60	1	1	1	1	2	2	3	4	6	7	7	9	11	13	20	24	30	36	40	47	67	80	90	106
50	1	1	1	1	1	2	2	4	4	7	7	9	10	13	14	26	27	38	40	51	54	87	91	115	121
	10	1	1	1	1	2	2	4	4	7	7	9	10	13	14	26	27	38	40	58	61	86	91	115	121
	25	1	1	1	1	2	2	5	5	7	7	9	10	16	16	26	27	38	40	58	61	86	91	115	121
	40	1	1	1	1	2	2	5	5	7	8	9	10	16	17	26	28	45	47	60	62	89	93	118	124
80	1	1	1	1	1	3	3	7	7	10	10	13	13	22	23	37	38	64	66	85	88	127	132	192	198
	5	1	1	1	1	3	3	7	7	10	10	13	13	22	23	37	38	64	66	85	88	127	131	192	198
	15	1	1	1	1	3	3	7	7	10	10	15	15	22	23	37	38	63	65	84	87	126	130	191	196
	25	1	1	2	2	3	3	7	7	10	10	15	16	23	24	44	45	65	67	87	89	148	152	197	202
100	1	1	1	1	1	3	4	8	8	12	12	18	19	27	28	44	46	77	79	102	105	153	157	•••	•••
	5	1	1	2	2	3	4	8	8	11	12	18	19	27	28	44	46	77	79	102	105	175	179	•••	•••
	10	1	1	2	2	3	4	8	8	11	12	18	19	27	28	51	53	77	79	102	105	175	179	•••	•••
	20	1	1	2	2	4	4	8	8	14	14	19	19	28	28	53	54	79	81	106	108	180	184	•••	•••
200	1	1	1	3	3	7	7	17	17	25	25	33	34	58	59	96	98	144	146	•••	•••	•••	•••	•••	•••
	5	2	2	3	3	7	7	17	17	25	25	33	34	58	59	96	98	166	168	•••	•••	•••	•••	•••	•••
	10	2	2	3	3	7	8	17	18	26	26	34	35	60	61	99	101	171	173	•••	•••	•••	•••	•••	•••
300	1	2	2	4	4	10	10	24	25	36	37	57	57	85	86	142	143	•••	•••	•••	•••	•••	•••	•••	•••
	3	2	2	4	4	10	10	24	25	36	37	57	57	85	86	163	165	•••	•••	•••	•••	•••	•••	•••	•••
	6	2	2	4	5	13	13	25	25	44	44	58	58	87	88	166	168	•••	•••	•••	•••	•••	•••	•••	•••
500	1	3	3	7	7	20	20	40	40	70	70	93	94	140	140	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	3	3	7	7	20	20	40	40	70	70	93	94	161	162	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	4	4	4	7	7	21	21	49	49	73	73	97	97	167	167	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
750	1	5	5	10	10	30	30	70	70	105	105	139	140	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	5	5	10	10	30	30	70	71	105	106	162	162	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
1000	1	7	7	16	16	47	47	93	93	161	161	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	7	7	17	17	49	49	97	97	167	167	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
2000	1	17	17	39	39	97	97	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••

UNIVAC 9300/9300 II Systems
Memory Size: 24K Bytes

UNISERVO VI C Subsystem: 9 Track
1 Control Unit
5 Tape Units

Table F–2. UNIVAC 9300/9300 II Systems Tape Sort Timing (Part 11 of 16)

Record Size (in bytes)	Blocking Factor	Volume (in thousands)																					
		1		2		5		10		15		20		30		50		75		100		150		200	
		Key Size (in bytes)																					
		10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30
20	1	1	0	1	0	2	0	3	0	5	0	7	0	10	0	18	0	27	0	36	0	54	0	83	0
	20	1	0	1	0	2	0	3	0	5	0	6	0	9	0	18	0	27	0	36	0	62	0	82	0
	50	1	0	1	0	2	0	3	0	5	0	6	0	9	0	18	0	27	0	36	0	62	0	82	0
	100	1	0	1	0	2	0	4	0	5	0	7	0	10	0	18	0	27	0	36	0	62	0	83	0
30	1	1	1	1	1	2	2	4	4	5	6	7	8	10	12	20	24	29	35	39	47	67	81	89	108
	20	1	1	1	1	2	2	4	4	5	6	7	8	12	14	20	24	29	35	39	47	67	81	89	107
	40	1	1	1	1	2	2	4	4	5	6	7	8	12	14	20	24	29	35	45	54	67	81	89	107
	60	1	1	1	1	2	2	4	4	5	6	7	8	12	14	19	23	29	35	44	53	66	80	88	106
50	1	1	1	1	1	2	2	4	5	6	7	8	9	14	16	23	26	34	39	54	60	80	90	107	120
	10	1	1	1	1	2	2	4	5	6	7	8	9	14	16	23	26	40	45	53	60	80	90	106	120
	25	1	1	1	1	2	3	4	5	6	7	10	11	14	16	23	26	40	45	54	60	80	90	107	120
	40	1	1	1	1	2	3	4	5	6	7	10	11	15	16	24	26	42	46	56	61	83	91	111	121
80	1	1	1	1	1	3	3	6	6	10	11	14	14	20	21	33	35	59	61	78	81	117	121	180	186
	5	1	1	1	1	3	3	6	6	10	11	14	14	20	21	33	34	59	61	78	81	117	121	180	186
	15	1	1	1	1	3	3	6	6	10	11	13	14	20	21	39	40	68	60	77	80	115	120	179	184
	25	1	1	1	1	3	3	6	6	11	11	14	14	21	21	41	42	61	63	81	84	140	145	•••	•••
100	1	1	1	1	1	4	4	7	7	12	13	16	17	24	25	47	48	70	72	94	96	140	144	•••	•••
	5	1	1	1	1	4	4	7	7	12	13	16	17	24	25	47	48	70	72	94	96	163	167	•••	•••
	10	1	1	1	1	4	4	7	7	12	13	16	17	24	25	47	48	70	72	94	96	163	167	•••	•••
	20	1	1	1	2	4	4	9	9	13	13	17	17	25	26	49	51	74	76	98	101	171	175	•••	•••
200	1	1	1	3	3	6	6	15	15	22	22	29	30	53	53	88	89	131	133	•••	•••	•••	•••	•••	•••
	5	1	1	3	3	6	6	15	15	22	22	35	36	53	53	88	89	154	156	•••	•••	•••	•••	•••	•••
	10	1	1	3	3	8	8	16	16	23	24	37	38	55	56	92	93	162	164	•••	•••	•••	•••	•••	•••
300	1	2	2	4	4	11	11	21	22	39	39	52	52	77	78	128	130	•••	•••	•••	•••	•••	•••	•••	•••
	3	2	2	4	4	11	11	21	22	39	39	52	52	77	78	151	153	•••	•••	•••	•••	•••	•••	•••	•••
	6	2	2	4	4	11	11	22	22	40	41	53	54	80	81	157	159	•••	•••	•••	•••	•••	•••	•••	•••
500	1	3	3	6	6	18	18	43	43	64	64	85	85	127	127	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	3	3	6	6	18	18	43	43	64	64	85	85	150	150	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	4	3	3	8	8	19	19	45	45	67	68	90	90	158	159	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
750	1	5	5	11	11	26	26	64	64	95	96	127	127	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	5	5	11	11	33	33	65	65	97	97	153	153	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
1000	1	6	6	14	14	43	43	85	85	150	150	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	8	8	15	15	45	45	90	90	158	159	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
2000	1	15	15	36	36	90	90	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••

UNIVAC 9300/9300 II Systems
Memory Size: 24K Bytes

UNISERVO VI C Subsystem: 9 Track
1 Control Unit
6 Tape Units

Table F–2. UNIVAC 9300/9300 II Systems Tape Sort Timing (Part 12 of 16)

Record Size (in bytes)	Blocking Factor	Volume (in thousands)																					
		1		2		5		10		15		20		30		50		75		100		150		200	
		Key Size (in bytes)																					
		10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30
20	1	1	0	1	0	2	0	4	0	6	0	8	0	13	0	23	0	36	0	48	0	78	0	111	0
	20	1	0	1	0	2	0	4	0	6	0	8	0	13	0	22	0	36	0	52	0	77	0	111	0
	50	1	0	1	0	2	0	4	0	6	0	8	0	13	0	22	0	36	0	52	0	83	0	111	0
	100	1	0	1	0	2	0	4	0	6	0	8	0	12	0	24	0	36	0	51	0	82	0	109	0
30	1	1	1	1	1	2	2	4	5	6	7	9	11	15	17	26	31	39	46	57	66	91	105	121	140
	20	1	1	1	1	2	2	4	5	6	7	9	11	15	17	26	31	42	49	56	65	91	105	129	149
	40	1	1	1	1	2	2	4	5	6	7	9	11	15	17	26	31	42	49	56	65	91	105	129	149
	60	1	1	1	1	2	2	4	5	7	8	9	11	15	17	26	31	42	49	56	65	91	105	129	149
50	1	1	1	1	1	3	3	5	6	9	9	13	13	19	20	34	35	55	57	79	82	126	131	168	175
	10	1	1	1	1	3	3	5	6	9	9	13	13	19	20	37	38	55	57	79	82	126	131	168	175
	25	1	1	1	1	3	3	5	6	9	9	13	13	21	21	37	38	59	62	79	82	126	131	180	186
	40	1	1	1	1	3	3	6	6	9	9	13	13	20	21	36	38	59	61	78	81	125	130	178	184
80	1	1	1	2	2	4	4	9	9	14	14	18	19	30	31	54	56	88	90	126	129	203	207	270	276
	5	1	1	2	2	4	4	8	9	14	14	18	19	30	31	54	55	88	90	126	129	203	207	270	275
	15	1	1	2	2	4	4	8	9	14	14	20	21	30	31	59	60	88	90	126	129	203	207	270	275
	25	1	1	2	2	4	4	8	9	14	14	20	21	33	34	59	60	95	97	126	129	203	207	288	294
100	1	1	1	2	2	5	5	10	10	17	17	24	25	40	41	72	73	108	110	155	157	249	253	355	360
	5	1	1	2	2	5	5	10	10	17	17	24	25	40	41	72	73	116	118	155	157	249	253	355	360
	10	1	1	2	2	5	5	11	12	17	17	24	25	40	41	72	73	116	118	155	157	249	253	355	360
	20	1	1	2	2	5	5	11	12	18	19	24	25	40	41	72	73	116	118	166	169	249	253	355	360
200	1	2	2	3	3	10	10	23	23	35	35	50	51	82	83	148	149	239	241	319	321	•••	•••	•••	•••
	5	2	2	4	4	10	10	23	23	38	38	50	51	82	83	148	149	239	241	342	344	•••	•••	•••	•••
	10	2	2	4	4	11	11	23	23	38	38	55	55	82	83	148	149	239	241	342	344	•••	•••	•••	•••
300	1	2	3	5	5	15	16	34	34	56	56	81	82	132	132	236	237	•••	•••	•••	•••	•••	•••	•••	•••
	3	2	3	5	5	15	16	37	38	56	56	81	82	132	132	236	237	•••	•••	•••	•••	•••	•••	•••	•••
	6	2	3	6	6	15	16	37	38	61	61	81	82	132	132	236	237	•••	•••	•••	•••	•••	•••	•••	•••
500	1	4	4	9	9	28	28	67	67	100	100	145	145	234	235	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	4	4	9	9	28	28	67	67	109	109	145	145	234	234	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	4	4	4	10	10	31	31	67	67	109	109	145	145	234	234	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
750	1	7	7	15	15	46	46	99	100	162	162	233	233	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	7	7	15	15	46	46	108	108	175	175	233	233	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
1000	1	9	9	22	22	66	66	144	144	233	233	333	333	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	10	10	22	22	66	66	144	144	233	233	333	333	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
2000	1	22	22	53	53	144	144	333	333	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••

UNIVAC 9300/9300 II Systems
Memory Size: 32K Bytes

UNISERVO VI C Subsystem: 9 Track
1 Control Unit
3 Tape Units

Table F–2. UNIVAC 9300/9300 II Systems Tape Sort Timing (Part 13 of 16)

Record Size (in bytes)	Blocking Factor	Volume (in thousands)																					
		1		2		5		10		15		20		30		50		75		100		150		200	
		Key Size (in bytes)																					
		10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30
20	1	1	0	1	0	2	0	3	0	5	0	7	0	10	0	19	0	28	0	42	0	63	0	92	0
	20	1	0	1	0	2	0	3	0	5	0	7	0	10	0	19	0	28	0	42	0	62	0	92	0
	50	1	0	1	0	2	0	3	0	5	0	7	0	10	0	19	0	28	0	42	0	62	0	92	0
	100	1	0	1	0	2	0	3	0	5	0	7	0	11	0	19	0	31	0	41	0	61	0	90	0
30	1	1	1	1	1	2	2	3	4	6	7	7	9	12	15	20	24	34	40	45	53	74	88	99	118
	20	1	1	1	1	2	2	3	4	6	7	7	9	12	14	20	24	34	40	44	53	74	88	98	117
	40	1	1	1	1	2	2	3	4	6	7	7	9	12	14	20	24	33	40	44	53	74	88	98	117
	60	1	1	1	1	2	2	4	5	6	7	7	9	12	14	20	24	33	40	44	53	74	88	98	117
50	1	1	1	1	1	2	2	4	5	6	7	10	11	14	16	26	30	39	45	58	67	87	100	116	133
	10	1	1	1	1	2	2	4	5	6	7	10	11	14	16	26	30	39	45	58	67	87	100	115	133
	25	1	1	1	1	2	2	4	5	6	7	10	11	14	16	26	30	39	45	58	67	87	100	127	147
	40	1	1	1	1	2	2	4	5	6	7	9	11	14	16	26	30	38	44	57	66	85	98	126	145
80	1	1	1	1	1	3	3	6	6	10	11	13	14	23	24	37	39	63	65	84	87	140	145	187	193
	5	1	1	1	1	3	3	6	6	10	11	13	14	23	24	37	39	63	65	84	87	140	145	187	192
	15	1	1	1	1	3	3	6	6	10	11	13	14	23	24	37	39	63	65	84	87	140	145	187	192
	25	1	1	1	1	3	3	6	6	10	11	13	14	23	24	37	39	63	65	84	87	140	145	187	192
100	1	1	1	2	2	4	4	7	7	12	13	16	16	27	28	45	47	76	79	102	105	171	175	•••	•••
	5	1	1	2	2	4	4	8	9	12	12	16	16	27	28	45	47	76	79	102	105	170	175	•••	•••
	10	1	1	2	2	4	4	8	9	12	12	16	16	27	28	51	53	76	79	102	105	170	175	•••	•••
	20	1	1	2	2	4	4	8	9	12	12	18	19	27	28	51	53	76	79	114	117	170	175	•••	•••
200	1	1	1	2	2	6	7	15	15	25	26	34	34	57	58	95	97	161	163	•••	•••	•••	•••	•••	•••
	5	1	1	2	2	8	8	15	15	25	26	34	34	57	58	95	97	161	163	•••	•••	•••	•••	•••	•••
	10	1	1	3	3	8	8	15	15	25	26	34	34	57	58	95	97	161	163	•••	•••	•••	•••	•••	•••
300	1	2	2	4	4	11	11	25	25	37	37	56	57	84	85	158	159	•••	•••	•••	•••	•••	•••	•••	•••
	3	2	2	4	4	11	11	25	25	37	37	56	57	84	85	158	159	•••	•••	•••	•••	•••	•••	•••	•••
	6	2	2	4	4	11	11	25	25	37	37	56	57	84	85	158	159	•••	•••	•••	•••	•••	•••	•••	•••
500	1	3	3	6	6	20	20	40	40	69	70	92	93	156	157	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	3	3	6	6	20	20	40	40	69	70	92	93	156	157	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	4	3	3	7	7	20	20	46	46	69	69	92	92	155	156	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
750	1	5	5	10	11	30	30	68	69	103	103	154	155	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	5	5	10	11	30	30	68	69	116	116	154	155	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
1000	1	6	6	14	14	40	40	91	91	154	155	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	7	7	14	14	46	46	91	91	154	155	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
2000	1	16	16	32	32	103	103	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••

UNIVAC 9300/9300 II Systems
Memory Size: 32K Bytes

UNISERVO VI C Subsystem: 9 Track
1 Control Unit
4 Tape Units

Table F–2. UNIVAC 9300/9300 II Systems Tape Sort Timing (Part 14 of 16)

Record Size (in bytes)	Blocking Factor	Volume (in thousands)																					
		1		2		5		10		15		20		30		50		75		100		150		200	
		Key Size (in bytes)																					
		10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30
20	1	1	0	1	0	2	0	3	0	5	0	6	0	9	0	17	0	25	0	33	0	56	0	75	0
	20	1	0	1	0	2	0	3	0	5	0	6	0	9	0	17	0	25	0	33	0	56	0	74	0
	50	1	0	1	0	2	0	3	0	5	0	6	0	9	0	17	0	25	0	37	0	56	0	74	0
	100	1	0	1	0	2	0	3	0	5	0	6	0	10	0	16	0	24	0	37	0	55	0	73	0
30	1	1	1	1	1	2	2	3	4	5	6	6	8	11	13	18	21	26	31	40	47	60	71	80	94
	20	1	1	1	1	2	2	3	4	5	6	8	7	11	13	18	21	30	36	40	47	60	71	79	94
	40	1	1	1	1	2	2	3	4	5	6	6	7	11	13	18	21	30	36	40	47	60	71	79	94
	60	1	1	1	1	2	2	3	4	5	6	6	7	11	13	18	21	30	36	40	47	60	71	89	106
50	1	1	1	1	1	2	2	4	4	6	6	9	10	13	14	21	24	36	40	47	54	71	80	107	121
	10	1	1	1	1	2	2	4	4	6	6	9	10	13	14	21	23	36	40	47	53	80	90	107	120
	25	1	1	1	1	2	2	4	4	6	6	9	10	13	14	24	27	36	40	47	53	80	90	107	120
	40	1	1	1	1	2	2	4	4	7	7	9	10	13	14	24	27	36	40	47	53	80	90	107	120
80	1	1	1	1	1	3	3	5	5	9	9	12	12	17	18	34	35	50	53	67	70	116	120	154	159
	5	1	1	1	1	3	3	5	5	9	9	12	12	17	18	34	35	50	52	67	70	115	120	154	159
	15	1	1	1	1	3	3	5	5	9	9	12	12	17	18	34	35	50	52	77	80	115	120	154	159
	25	1	1	1	1	3	3	6	6	9	9	12	12	20	21	34	35	50	52	77	80	115	120	154	159
100	1	1	1	1	1	3	3	7	8	11	11	14	15	25	25	41	42	61	63	93	96	140	144	***	***
	5	1	1	1	1	3	3	7	8	11	11	14	15	25	25	41	42	61	63	93	96	140	144	***	***
	10	1	1	1	1	3	3	7	8	11	11	14	15	25	25	41	42	61	63	93	96	140	144	***	***
	20	1	1	1	1	3	3	7	8	11	11	14	15	25	25	41	42	70	72	93	96	140	144	***	***
200	1	1	1	2	2	5	5	13	13	19	19	30	30	45	46	87	88	130	132	***	***	***	***	***	***
	5	1	1	2	2	7	7	13	13	23	23	30	30	45	46	87	88	130	132	***	***	***	***	***	***
	10	1	1	2	2	7	7	13	13	23	23	30	30	45	46	87	88	130	132	***	***	***	***	***	***
300	1	2	2	3	3	9	9	18	18	33	33	43	44	65	66	127	128	***	***	***	***	***	***	***	***
	3	2	2	3	3	9	9	22	22	33	33	43	44	76	77	127	128	***	***	***	***	***	***	***	***
	6	2	2	3	3	9	9	22	22	33	33	43	44	76	77	127	128	***	***	***	***	***	***	***	***
500	1	3	3	5	5	15	15	36	36	53	53	83	84	125	126	***	***	***	***	***	***	***	***	***	***
	2	3	3	6	6	15	15	36	36	53	53	83	84	125	126	***	***	***	***	***	***	***	***	***	***
	4	3	3	6	6	15	15	36	36	53	53	83	84	125	125	***	***	***	***	***	***	***	***	***	***
750	1	4	4	9	9	27	27	53	53	93	93	124	124	***	***	***	***	***	***	***	***	***	***	***	***
	2	4	4	9	9	27	27	53	53	93	93	124	124	***	***	***	***	***	***	***	***	***	***	***	***
1000	1	6	6	12	12	35	35	83	83	124	124	***	***	***	***	***	***	***	***	***	***	***	***	***	***
	2	6	6	12	12	35	35	83	83	124	124	***	***	***	***	***	***	***	***	***	***	***	***	***	***
2000	1	12	12	28	28	83	83	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***

UNIVAC 9300/9300 II Systems
Memory Size: 32K Bytes

UNISERVO VI C Subsystem: 9 Track
1 Control Unit
5 Tape Units

Table F–2. UNIVAC 9300/9300 II Systems Tape Sort Timing (Part 15 of 16)

Record Size (in bytes)	Blocking Factor	Volume (in thousands) / Key Size (in bytes)																					
		1		2		5		10		15		20		30		50		75		100		150		200	
		10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30
20	1	1	0	1	0	2	0	3	0	4	0	7	0	10	0	16	0	27	0	36	0	54	0	72	0
	20	1	0	1	0	2	0	3	0	4	0	7	0	10	0	16	0	27	0	36	0	54	0	72	0
	50	1	0	1	0	2	0	3	0	4	0	7	0	10	0	16	0	27	0	36	0	54	0	72	0
	100	1	0	1	0	2	0	3	0	5	0	7	0	10	0	16	0	27	0	36	0	54	0	82	0
30	1	1	1	1	1	2	2	3	4	5	6	7	8	10	12	16	20	29	35	38	46	57	69	88	106
	20	1	1	1	1	2	2	3	4	5	6	7	8	10	12	19	23	29	35	38	46	57	69	87	105
	40	1	1	1	1	2	2	3	4	5	6	7	8	10	12	19	23	29	34	38	46	57	68	87	105
	60	1	1	1	1	2	2	3	4	5	6	7	8	10	12	19	23	29	34	38	46	57	68	87	105
50	1	1	1	1	1	2	2	4	5	6	7	8	9	11	13	22	26	33	39	44	51	75	89	100	119
	10	1	1	1	1	2	2	4	5	6	7	8	9	11	13	22	26	33	39	43	51	75	89	100	118
	25	1	1	1	1	2	2	4	5	6	7	8	9	11	13	22	26	33	39	43	51	75	89	100	118
	40	1	1	1	1	2	2	4	5	6	7	8	9	13	16	22	26	33	39	50	59	75	89	100	118
80	1	1	1	1	1	2	3	5	6	8	8	10	11	18	19	30	31	44	47	70	73	105	109	139	145
	5	1	1	1	1	2	2	5	6	8	8	10	11	18	19	30	31	44	47	70	73	104	109	139	145
	15	1	1	1	1	2	2	5	6	8	8	10	11	18	19	30	31	52	55	70	73	104	109	139	145
	25	1	1	1	1	2	3	5	6	8	8	12	13	18	19	30	31	53	55	70	73	105	109	140	145
100	1	1	1	1	1	3	3	6	6	9	9	15	15	22	22	36	37	63	65	84	87	126	130	•••	•••
	5	1	1	1	1	3	3	6	6	9	9	15	15	22	22	36	37	63	65	84	87	126	130	•••	•••
	10	1	1	1	1	3	3	6	6	9	9	15	15	22	22	36	37	63	65	84	87	126	130	•••	•••
	20	1	1	1	1	3	3	6	6	9	9	15	15	22	23	36	37	63	66	85	87	126	131	•••	•••
200	1	1	1	2	2	6	6	13	14	20	20	26	27	39	40	78	79	116	118	•••	•••	•••	•••	•••	•••
	5	1	1	2	2	6	6	13	14	20	20	26	27	39	40	78	79	116	118	•••	•••	•••	•••	•••	•••
	10	1	1	2	2	6	6	13	14	20	20	26	27	47	48	78	79	117	119	•••	•••	•••	•••	•••	•••
300	1	2	2	3	3	8	8	19	19	28	29	38	38	68	69	113	114	•••	•••	•••	•••	•••	•••	•••	•••
	3	2	2	3	3	8	8	19	19	28	29	38	38	68	69	113	114	•••	•••	•••	•••	•••	•••	•••	•••
	6	2	2	3	3	8	8	19	19	28	29	38	38	68	69	113	114	•••	•••	•••	•••	•••	•••	•••	•••
500	1	2	2	5	5	16	16	31	31	56	56	74	75	111	112	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	2	2	5	5	16	16	31	31	56	56	74	75	111	112	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	4	3	3	5	5	16	16	31	31	56	56	74	75	111	112	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
750	1	4	4	7	8	23	23	55	56	83	83	110	111	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	4	4	7	8	23	23	55	56	83	83	110	111	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
1000	1	5	5	12	13	30	31	74	74	110	111	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
	2	5	5	13	13	31	31	74	74	111	111	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••
2000	1	13	13	25	25	74	74	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••

UNIVAC 9300/9300 II Systems
Memory Size: 32K Bytes

UNISERVO VI C Subsystem: 9 Track
1 Control Unit
6 Tape Units

Table F—2. UNIVAC 9300/9300 II Systems Tape Sort Timing (Part 16 of 16)

INDEX

T

Comments concerning this manual may be made in the space provided below. Please fill in the requested information.

System: _____

Manual Title: _____

UP No: _____ Revision No: _____ Update: _____

Name of User: _____

Address of User: _____

Comments:

CUT

FOLD

FIRST CLASS
PERMIT NO. 21
BLUE BELL, PA.

BUSINESS REPLY MAIL NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

POSTAGE WILL BE PAID BY

UNIVAC

P.O. BOX 500

BLUE BELL, PA. 19422

ATTN: SYSTEMS PUBLICATIONS DEPT.

FOLD

CUT